Air Cleaner

Description

This air cleaner element is of dry type. Remember that it needs cleaning according to the following method and interval.

1) Take out the cleaner element ① off the air cleaner case.

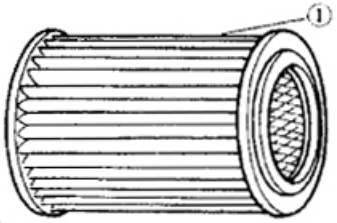


Fig. 5-1

2) Blow off dust by compressed air from inside of element.

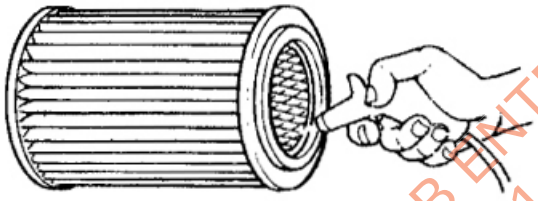


Fig. 5-2

NOTE:
If the element are heavily dirtied, wash it in household type detergent. After washing, rinse the detergent out of element, and dry it completely.

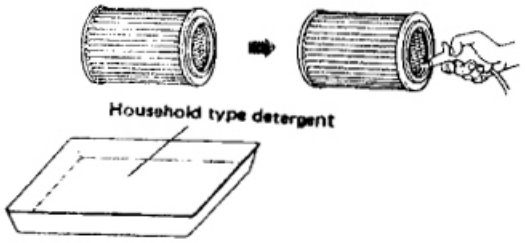


Fig. 5-3

Clean	Paved-road: Every 10,000km (6215 miles)
	Dusty condition: Every 2,500 km (1,553 miles) or as required
Replace	Every 40,000km (24,855 miles) NOTE: More frequent replacement if under dusty driving conditions.

Use of the selector lever (Option)

A mispositioned selector lever can cause the carburetor to get "iced" in freezing weather or the engine to overheat in hot weather. Position this lever according to the atmospheric temperature, i.e, in WINTER position when outside temperature is 15℃ (59℉) or below, or in SUMMER position when the temperature is above that level.

Warm-air selector lever position	
Atmospheric temperature	Lever position
15℃ (59℉) or below	WINTER
Above 15℃ (59℉)	SUMMER

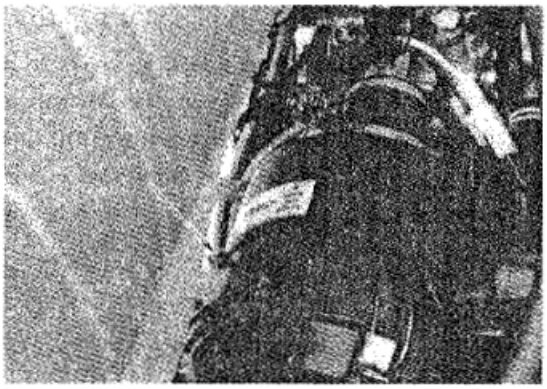


Fig. 5-4

Cyclone System

(This system device is installed in the vehicles used in certain dusty areas.)

Description

Cyclone is installed in front of the air cleaner inlet hose. Its purpose is to clean the air to be drawn into the air cleaner and the carburetor. It whirls the ingoing air and separates dust out of air with an effect of the centrifugal force produced in it.

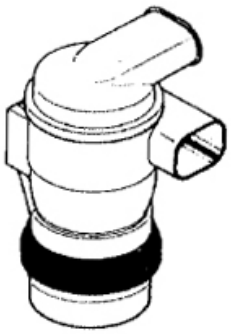


Fig. 5-5

Construction

The air is drawn into No. 1 chamber of Cyclone due to the suction negative pressure of the engine and enters No. 2 chamber through the holes of Plates① which are shaped like the fliers of a windmill. As the air passes, Plates ① give whirling motion to it. The centrifugal force which is produced by the whirling air current presses dust in the air against the inside wall of No. 2 chamber. Dust then drops down into cup ②along the wall. The air free from dust now is drawn into the air cleaner through No. 3 chamber.

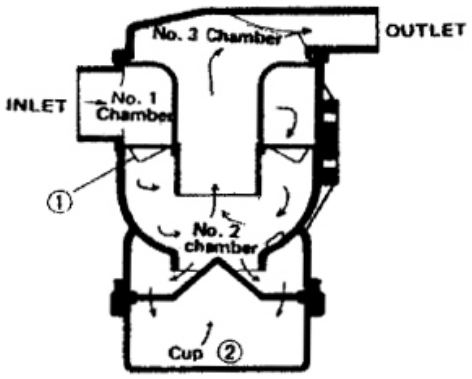
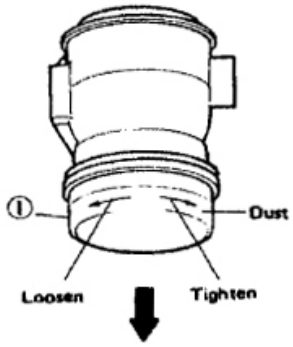


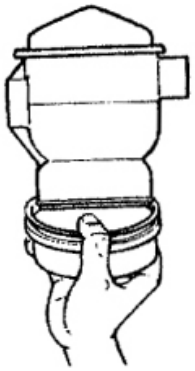
Fig. 5-6

Inspection and cleaning

Check the inside of cup① for dust every month. If dust collects up to the middle of the cup, remove the cup from cyclone, and clean the inside of cup.

Clean	Every month





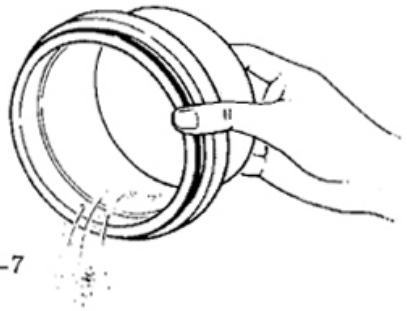


Fig. 5-7

Fuel Pump

Description

A pneumatic diaphragm pump is used to deliver gasoline to the float chamber in the carburetor. Its diaphragm is actuated from one of the cams formed of engine camshaft. A rocker arm rides on this cam and moves the pump diaphragm up and down.

Fuel pump specifications	
Discharge pressure	0. 25-0. 35 kg/cm² (3. 55-4. 97psi)
Pump capacity	1. 3litres/minute or better at 2,000 r/min

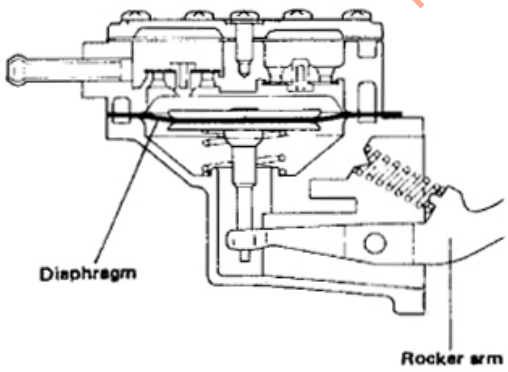


Fig. 5-8

Important pump disassembling step

Scribe match marks①across the joint seams to establish and identify the angular positions of upper half② and lower half ③ as shown in Fig. 5-8. This provision is necessary because the screw holes are so located as to permit the two halves to be angularly positioned in more than one way, whereas the pump can be piped only when the pump is assembled as shown.

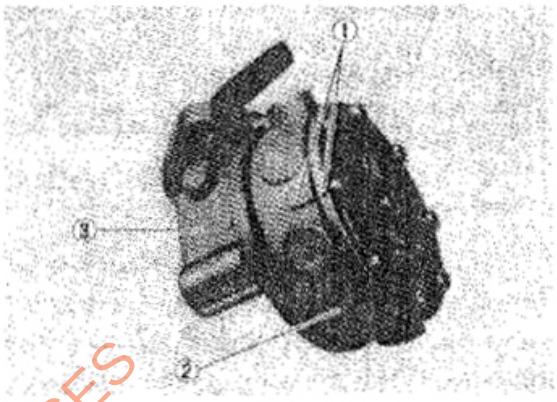


Fig. 5-9

Inspection

- Inspect the fuel pump in place for leakage.
- Be sure that the fuel hose is free of any sign of cracking.
- Be sure that the nuts securing the pump in place are tight.
- After disassembling the pump, examine the diaphragm to be sure it is in good condition, free of any evidence or rupture or breakage.

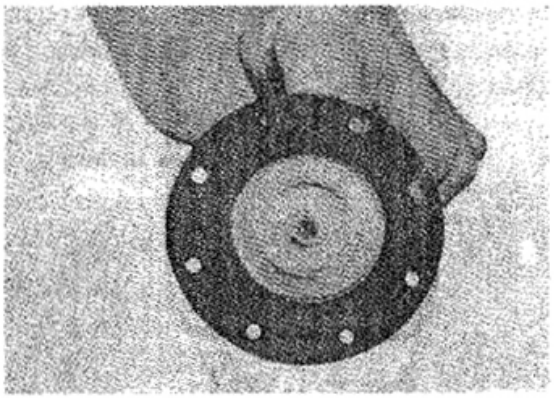


Fig. 5-10

Important pump reassembling

Be sure to fit the upper half and lower half as

guided by the match marks① given at the time of disassembly. With two halves②③ correctly positioned, run in the screws and tighten them equally.

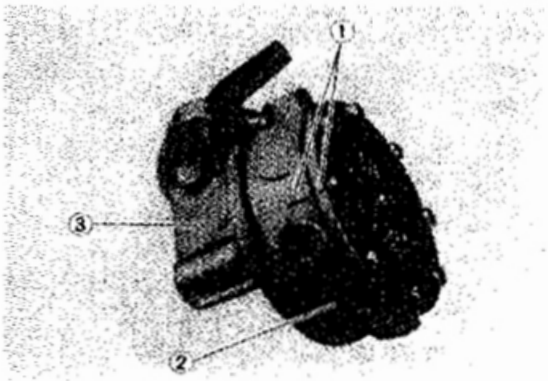


Fig. 5-10

Fuel Filter

Description

Fuel enters the filter through its inlet hole and, after passing through the filtering element, comes out of its outlet hole communicated to the fuel pump. This filter is not meant to be disassembled. It is of cartridge type, consisting of a filtering element in a plastic case.

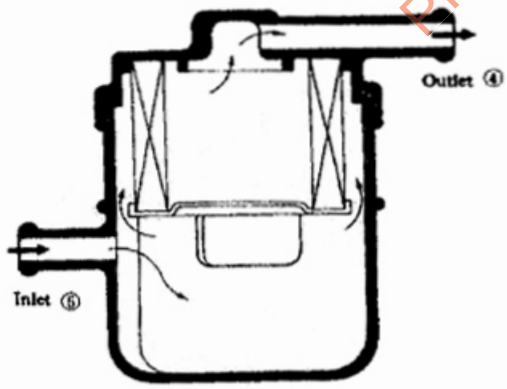


Fig. 5-11

Servicing and installation

As said before, this filter does not permit disassembly; it is to be replaced by a new one periodically. It is one of the expendable items.

Interval of fuel filter replacement	Every 40,000km (24855 miles)

CAUTION:
Fig. 5-11, Left, shows the fuel filter in its correct posture, with outlet④ coming on top side and inlet⑤ on bottom side.
Remember the relative positions of inlet and outlet when piping the filter.

SECTION 6D

ENGINE COOLING SYSTEM

CONTENT

Description

The engine is cooled by coolant set in forced recirculation through jackets formed in the engine body and through the radiator. For the water pump, a high-capacity centrifugal pump is used. For the radiator, a tube-and-fin type, large in heat dissipating capacity, is used.

The thermostat is of wax pellet type, accurately responsive to temperature changes and durable in construction. It maintains the coolant temperature within a narrow range during operation.

Cooling Water Circuit

The thermostat remains in closed condition-its valve is closed-when the coolant is cold. Under this condition, the coolant being pumped flows through the circuit comprising cylinder block, cylinder head, inlet manifold, bypass hose and water pump, in that order.

As the temperature rises to 82℃ (179℉) or thereabout, the thermostat begins to open, thereby allowing some of the coolant in recirculation to flow through the radiator. At about 95℃ (203℉) of rising coolant temperature, the thermostat becomes completely open so that little or no flow occurs through the bypass hose; the coolant now flow through the radiator and back to the pump, releasing the most of heat to the atmosphere through the radiator core.

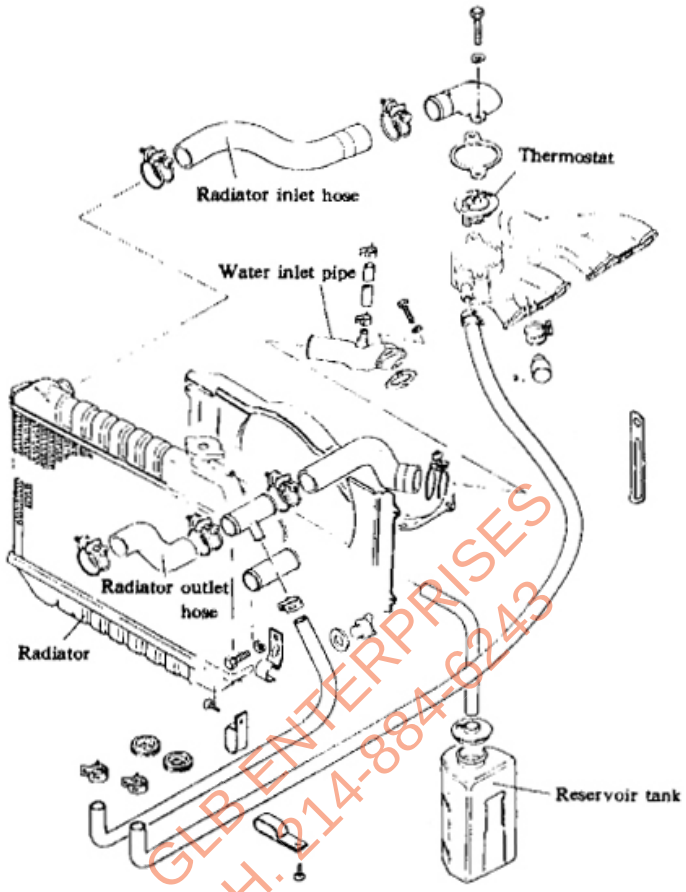


Fig. 6-1

Removal

1. Coolant draining

1) Loosen the drain plug ① on the radiator to empty its water side.

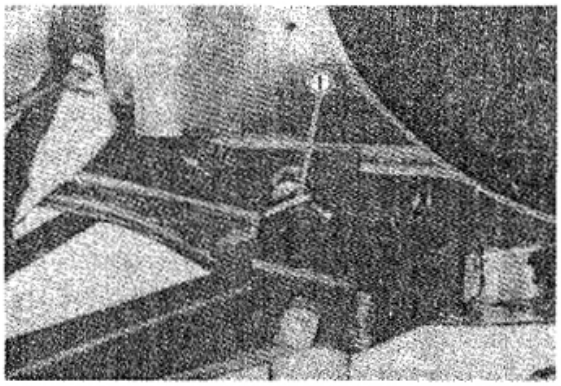


Fig. 6-2

2)The drain plug②for engine water jackets is located below the exhaust manifold. To change the coolant,or to drain the jackets for one reason or another,loosen this plug,too.

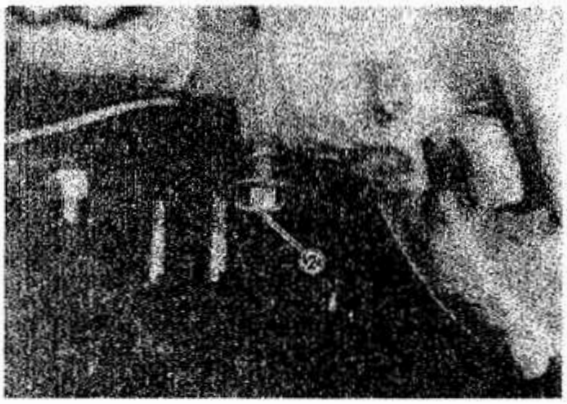


Fig. 6-3

2. **Removal of cooling water hoses**

To remove these hoses,loosen the screw on each hose clip and pull the hoses end off.

Fig. 6-4

3. **Radiator removal**

Loosen the bolts securing the radiator in place. Take down the radiator.

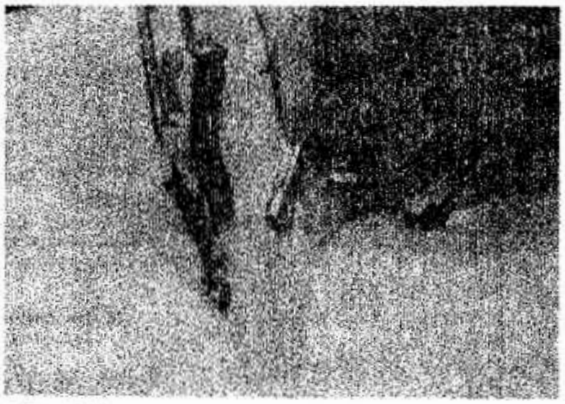


Fig. 6-5

4. **Cooling fan removal**

Removing the bolts securing the fan to the hub allows the fan to be detached.

Fig. 6-6

5. **Water pump removal**

In order to remove the water pump,it is not necessary to take down the engine. The method of removal is sequentially illustrated in Figs. 3-12 3-13,3-15,3-16,3-17,3-18,3-19,3-20,3-2 and 3-23.

In these figures,cautioning reminders are given. Be sure to pay attention to those reminders when removing the pump.

The method of re-installing the pump is sequentially illustrated in Figs. 3-136,3-137,3-139,3 140,3-141,3-142 and 3-143.

Functional Description of Major Components

Water reservoir tank

This reservoir, a small plastic tank, is so located relative to, and so associated with the radiator that it receives the excess coolant that would otherwise spill out by overflowing. The excess is due to coolant expansion caused by temperature rise. When the coolant cools down, its volume contracts, and the coolant in the reservoir returns to the radiator.

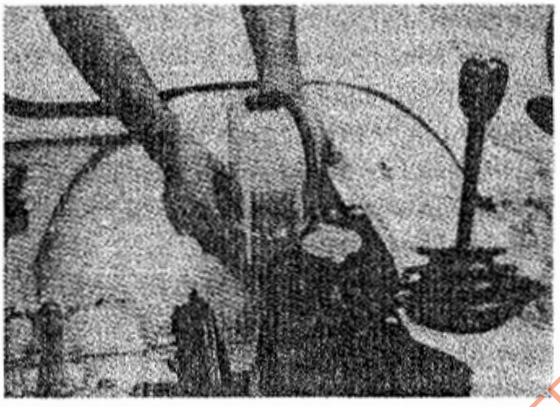


Fig. 6-7

Thermostat

The temperature-sensitive material in the thermostat is a wax pellet. It is hermetically contained in a metal case, and expands and contracts according as the coolant temperature rises and falls. When it expands, the case pushes down the valve to open it.

If, during operation, the valve is suspected of remaining closed while it is expected to open increasingly, the cause is most likely a ruptured wax case.

In the top portion of the thermostat, an air bleed hole is provided; this hole is for venting out the gas or air, if any, that has accumulated in the coolant circuit.

Thermostat functional specifications	
Temperature at which valve begins to open	82℃(179℉)
Temperature at which valve becomes full open	95℃(203℉)

Thermostat functional specifications	
Valve lift	8mm(0.31in.)

Thermostat

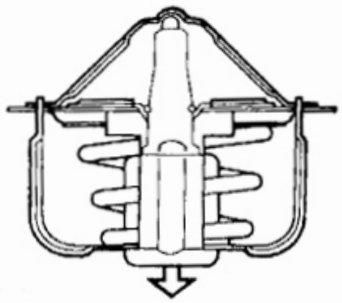


Fig. 6-8

Radiator filler cap

This cap has two built-in valves and, by these valves, allows the internal pressure of coolant circuit to rise to a certain level slightly above that of the atmosphere.

Of the two built-in valves, one is an adjusting valve and the other is a negative-pressure valve. The former opens only when the internal pressure rises by 0.9kg/cm². This means that the coolant's boiling temperature is substantially above 100℃(212℉)-if the coolant is straight water — and that, under normal running condition, no boiling occurs.

Following a shutting down of the engine, the coolant will cool off and the internal pressure will drop. If the pressure should be allowed to keep on falling, there happens the danger of coolant pipes and radiator cores becoming subjected to a large collapsing pressure; the pipes or radiator cores or any weakest point might give in. The negative-pressure valve opens in such a case to admit atmospheric pressure into the coolant circuit, thereby avoiding a build-up of negative pressure.

The cap has its face marked "0.9", which means that its pressure adjusting valve opens at 0.9km/cm².

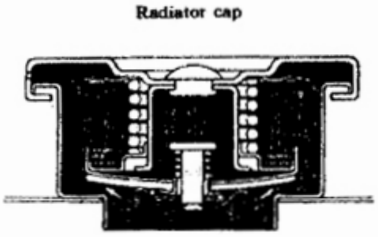


Fig. 6-9

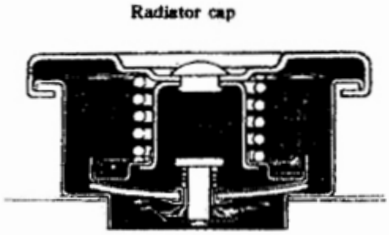


Fig. 6-10

Water pump

The pump rotor is supported by a totally sealed bearing and do not permit disassembly. For this reason, the pump must be replaced by a new one when any part of it has developed a malcondition.

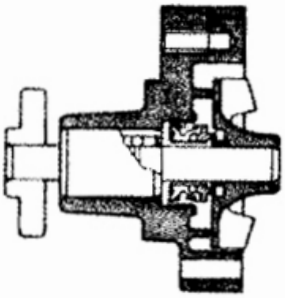


Fig. 6-11

Requirements on coolant

The long-term reliability and cooling capacity of the engine cooling system depends much on the quality of cooling water used. "Hard water", if used, will foul up the cooling circuit by scale formation, for such water is usually high in silicate and mineral contents. Scales are poor heat conductors.

Use of water high in acid concentration is just as bad; such water promotes rusting. For similar reasons, river water, well water, not to mention sea water, are not fit as engine cooling water.

Tap water available from city water supply is the best available water. Distilled water is ideal but is a luxury in most cases.

For protection of the cooling circuit, it is recommended that glycol be added to the cooling water in a proportion determined by the lowest atmospheric temperature expected.

Standard SC1010, SC1010X is shipped from the factory with its cooling circuit filled with a 50% solution of glycol, this solution does not freeze down to -36℃.

Many brands of ANTI-FREEZE compounds are sold in the market. In no case, allow two or more different brands to be mixed in the cooling circuit of the engine.

"GLYCOL Coolant" — "Anti-freeze and Summer Coolant" — its effects and use

(1) Effects of glycol coolant

(a) Its freezing temperature is much lower and depends on the concentration of glycol. It is an anti-freeze coolant.

(b) It does not corrode the metal surfaces of the cooling circuit. It is an anti-corrosion coolant.

(c) It does not develop foam or bubbles. It is a foam-inhibited coolant.

(d) It stands long usage. The renewal interval is much longer.

(2) How to proportion Anti-freeze coolant to cooling water

Anti-freeze coolant is a multi-purpose anti-freeze compound. Its aqueous solution as engine coolant can be kept in service as long as two years in a single stretch, regardless of changes of season.

To prepare an anti-freeze coolant with Anti-freeze coolant, proportion this compound to

water according to the following chart, in which the proportions are indicated for seven levels of temperature as the lowest expected levels:

ANTI-FREEZE PROPORTIONING CHART

Freezing temperature	℃	−9	−12	−16	−20	−25	−30	−36
	℉	16	10	3	−4	−13	−22	−33
Glycol concentration	%	20	25	30	35	40	45	50
Ratio of compound to cooling water	ltr.	0.90/3.60	1.13/3.37	1.35/3.15	1.57/2.93	1.80/2.70	2.05/2.45	2.25/2.25
	US pt.	1.90/7.60	2.38/7.12	2.85/6.65	3.33/6.17	3.80/5.70	4.28/5.22	4.75/4.75
	Imp. pt.	1.58/6.32	1.98/5.92	2.37/5.53	2.77/5.13	3.16/4.74	3.56/4.34	3.95/3.95

NOTE:
Remember, the radiator capacity is 4.5 litres which includes the reservoir tank capacity of 0.6 litre (1.3lb).

Water temperature gauge

This gauge constitutes a system of its own, with an indicator mounted in the instrument panel, an engine unit or sensor of thermistor type and a regulator for passing a constant current. These three are connected as shown in the diagram below:

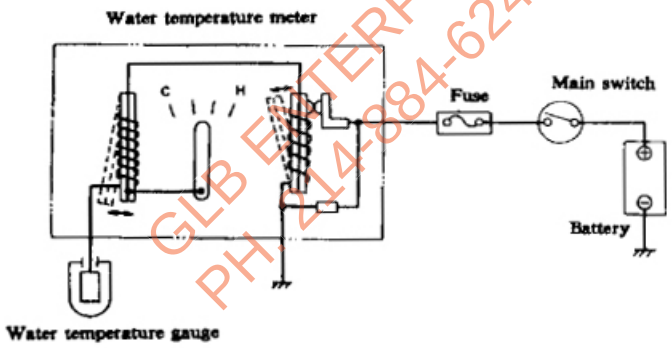


Fig. 6-13

The indicator is of bimetal type; its bimetal element is wrapped with a heater coil and becomes heated by the current flowing in the coil. By deflecting, the element actuates the indicating hand, making the hand move along the temperature scale.

The magnitude of the current is determined by the state of the thermistor in the engine unit. This unit is installed on the intake manifold. Speaking generally, a thermistor is a semiconductor resistive element whose ohmic resistance decreases as its temperature rises; its resistance has a negative temperature coefficient. When the coolant temperature rises, the thermistor offers a decreasing resistance, so that the current increases, thereby deflecting the indicating hand wider.

The regulator is a means of maintaining a constant current in the circuit for each ohmic resistance state of the thermistor, and does so function under the varying voltage condition of the battery.

Cooling System Services

Thermostat

If the thermostat valve is suspected of malfunctioning, check first the possibility of some foreign

matters being stuck on the valve seat to prevent the valve from seating tight. Next, check the thermostatic movement of the wax element in the following manner:

Heat water in a pan by placing the pan on a stove, as shown in Fig. 6-14. Grip the end of a thread or small string by pinching it in the valve and suspend the thermostat unit by holding the other end of the thread or string. Immerse it in the water, holding it about 20 mm (0. 78in) above the bottom, and read the water temperature on the column thermometer.

If the suspended unit falls to the bottom just when the temperature rises to 82℃ (179℉) or thereabout (which is the temperature at which the valve should begin to open), the thermostat unit may be deemed to be in sound condition.

If the valve begins to open at a temperature substantially below or above, the thermostat unit should be replaced by a new one. Such a unit, if re-used, will bring about overcooling or overheating tendency.

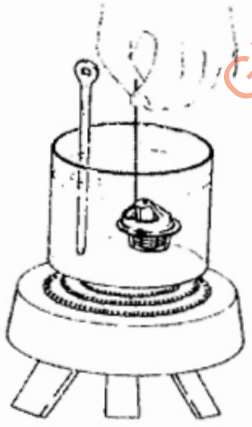


Fig. 6-14

Make sure that the air bleed hole of the thermostat is clear, no clogged.

Fig. 6-15

Fan belt

This belt drives both alternator and water pump. Check the belt for tension. The belt is in proper tension when a thumb pressure (*10*kg) applied to the middle point of its span deflects it about *10-15*mm (*0. 4-0. 6*in.). Inspect the belt for signs of deterioration and replace it as necessary.

Belt tension specification	*10-15*mm (*0. 4-0. 6*in.) as deflection

NOTE:
When replacing the belt with a new one, adjust belt tension to 8-10mm (0. 3-0. 4 in.)

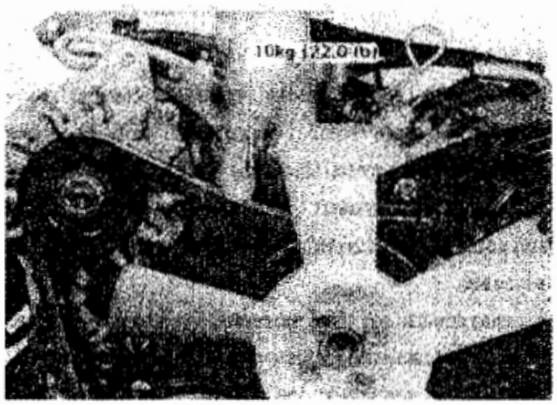


Fig. 6-16

To adjust the belt for proper tension, loosen the 3 bolts securing the generator in place, and displace it to slacken or tighten the belt.

A loose belt, or a belt tending to break off or otherwise defective, is often the cause of engine overheating. Because of the importance of this belt, it is strongly recommended that the belt be replaced at regular intervals even when the belt looks satisfactory in appearance.

Belt replacement interval	Two years (recommended)

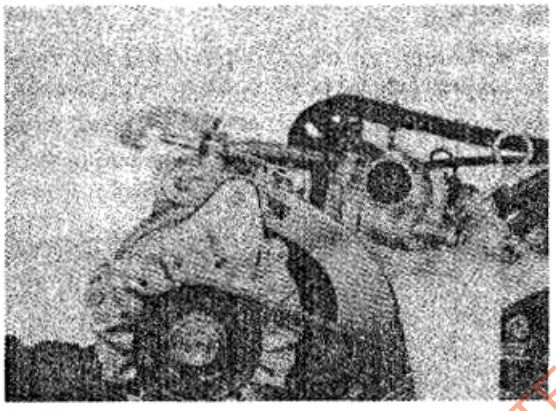


Fig. 6-17

Radiator

If the water side of the radiator is found excessively rusted or covered with scales, clean it by flushing with the radiator cleaner compound. This flushing should be carried out at regular intervals for scale or rust formation advances with time even where a recommended type of coolant is used. Periodical flushing will prove more economical. Excessive rust or scale will lower the cooling efficiency

Inspect the radiator cores and straighten the flattened or bent fins, if any. Clean the cores, removing road grimes and trashes.

Flattened or bent fins obstruct the flow of air through the core to impede heat dissipation.

Radiator flushing interval	Two years (recommended)

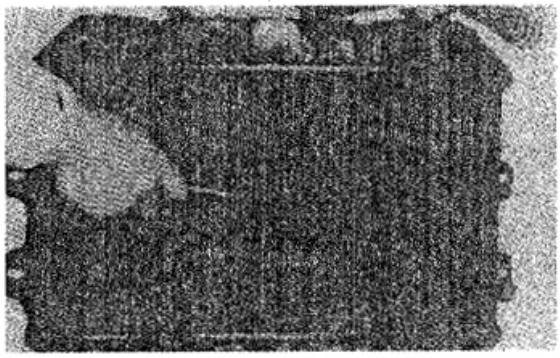


Fig. 6-18

Coolant level

Cooling water in service decreases its volume gradually on account of progressive loss due to water evaporation. Check to be sure that the water surface is up to anywhere between FULL and LOW marks on the reservoir tank. The user should be reminded of the need to daily check the water level.

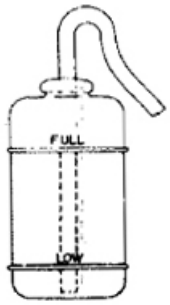


Fig. 6-19

Water hoses

Inspect each water hose for evidence of cracking or breakage, and be sure that its connection is tight. A defective hose or a hose showing signs of malcondition must be replaced. Tighten the hose connections as necessary.

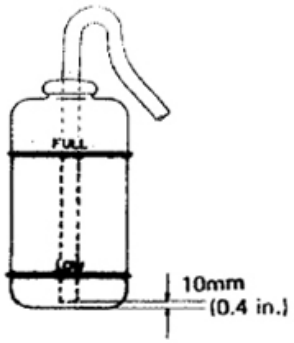


Fig. 6-21

Cooling fan

The cooling fan takes its position with two engraved cylinders facing outward (toward front side). Be sure to mount the fan as shown in Fig. 6-22.

Fig. 6-20

Important Reinstalling Steps

Filling up the cooling system

Park the machine on a flat level floor, and fill in until you see the coolant come up to the well part of the radiator filler. Then, run the engine two or three minutes to recirculate the coolant. This recirculation will drive out air, if any, trapped inside, and will lower the coolant surface at the filler. Add coolant until its surface shows up again in the filler, and fill up the reservoir tank, raising the surface to FULL mark.

NOTE:
Check to ensure that there is a clearance of 10mm (0.4in.) between the end of the rubber hose in the reservoir tank and the bottom of the tank.

Fig. 6-22

SECTION 6E

CAR HEATER

CONTENT

Description

The optional car heater is of hot water type. Its operation is quiet. It takes engine heat through the medium of water and sends warm air into the room by means of a blower.

Since the blower drive is electrical, independent of engine speed, the heater is just as effective even when the engine is running slowly. In summer, the blower doubles as a fan for room ventilation, with the heater valve kept closed.

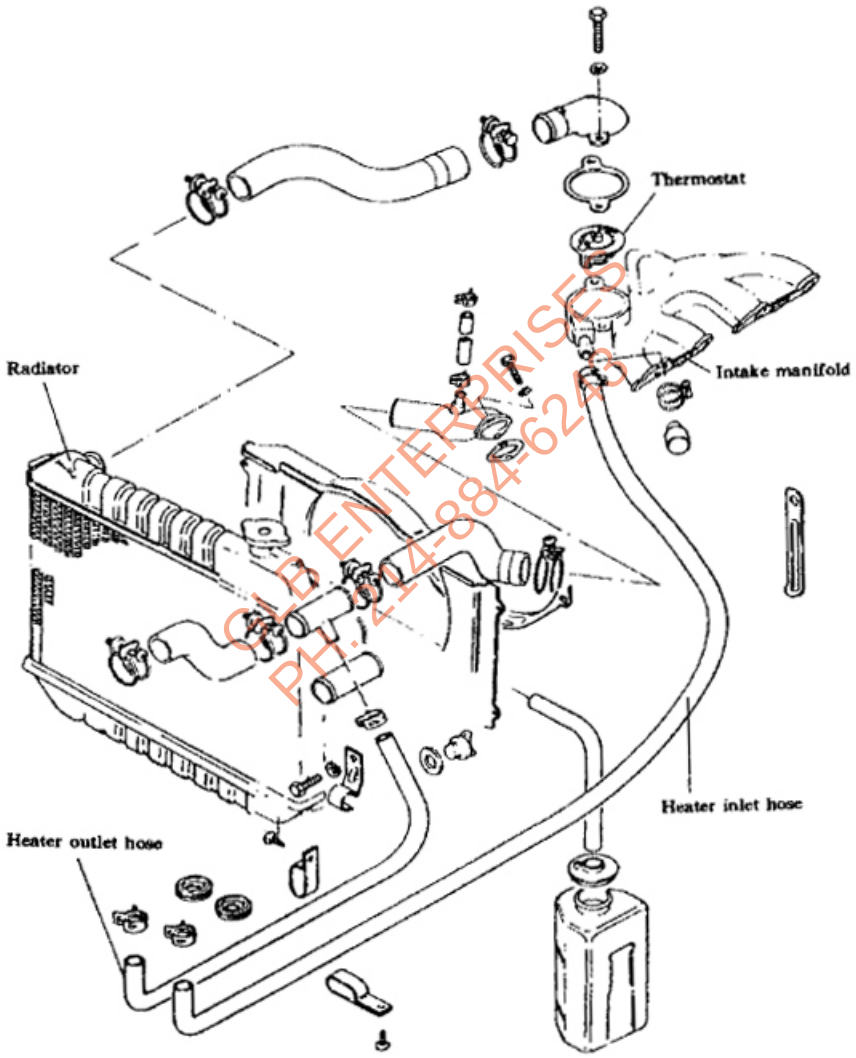


Fig. 7-1

Electrical Circuit

The circuit diagram shown in Fig. 7-2 illustrates how the blower motor is controlled. With the main switch closed, pulling the button of the fan switch to the first position passes a current through the motor. This current is small because the circuit has a resistor (indicated as "fan resistance" in the diagram); and the blower runs slow under this condition.

Pulling the switch button all the way (to the second position) throws the full battery voltage across the blower motor. A large current flows, and the blower runs with full speed.

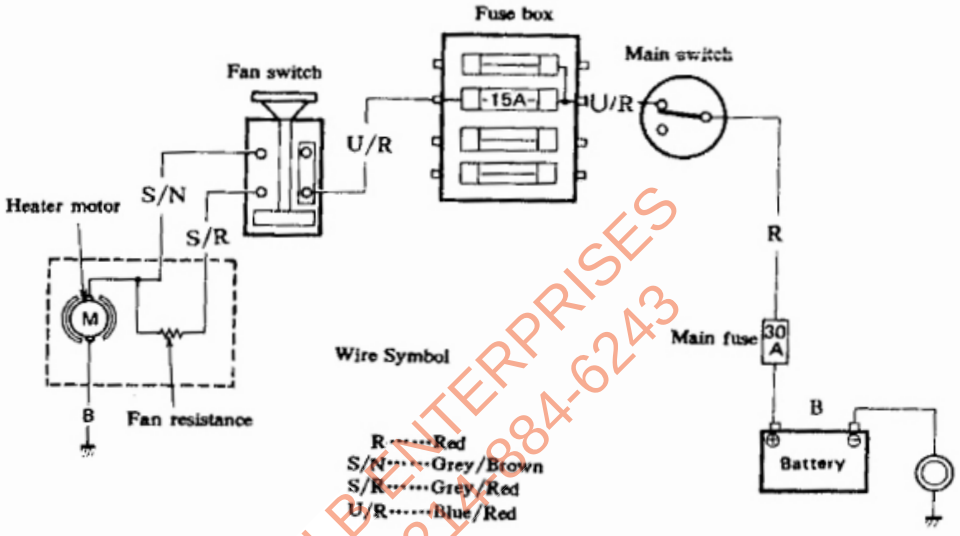


Fig. 7-2

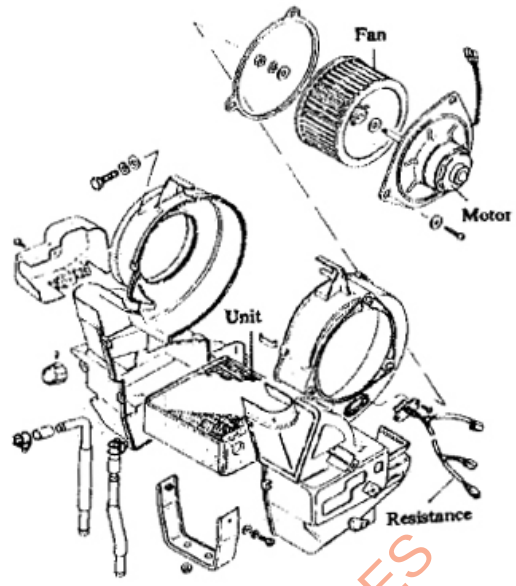


Fig. 7-2-1

Heater Services

Fan resistor

This resistor is in the heater case. Inspect it for signs of cracking or breakage and replace it as necessary. If the blower motor will not run or when you replace the existing resistor, check to be sure the resistor has an ohmic resistance of 4. 3 ohms. Use a circuit tester for this purpose.

Fan resistor specification	4. 3 ohms

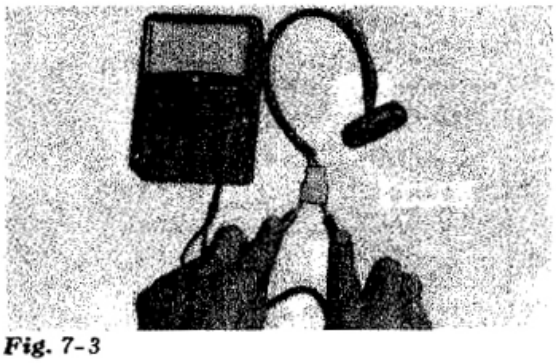


Fig. 7-3

Fan switch

Using a circuit tester, check this switch for circuit continuity:

(1)Switch button in first position
Continuity should be verified betweenS/R and U/R.

(2)Switch button in second position
Continuity should be verified between S/N and U/R.

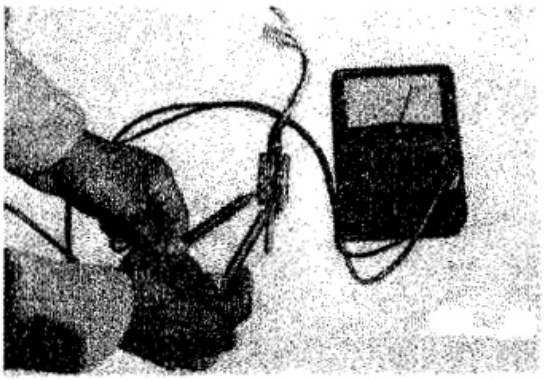


Fig. 7-4

Heater valve

This valve is installed in the heater box. When warm air is wanted in the room, open the valve During the season not requiring the use of the heater, keep the valve closed.

The rough standard for opening and closing of the heater valve is about 20℃ (68℉) of the outside temperature.

NOTE:
Make sure not to leave the heater hose removed even when the heater is not used. This is important to prevent rust.

Rule of thumb on heater valve		
When outside temperature is:	Above 20℃ (68℉)	Keep the valve tight (closed)
	Below 20℃ (68℉)	Keep the valve loose (opened)

Fig. 7-5

SECTION 6F

IGNITION SYSTEM

CONTENT

Description

The principal components of the ignition system are, as shown in the circuit diagram of Fig. 8-1, the spark plugs, distributor, contact-breaker, ignition coil and, as the source of igniting energy, the battery. Note that the ignition coil has two windings, primary and secondary.

Current from the battery flows through the primary winding and then the contact-breaker; the contact point in the breaker opens and closes to interrupt this current intermittently.

Each time the primary current is interrupted, a very high voltage develops in secondary winding. It is this intermittent high voltage that the distributor passes sequentially to the four spark plugs to fly a spark across the gap in each, one plug a time.

The distributor is sort of rotary switch, whose rotor connects the four plugs, one at a time, to secondary winding of the ignition coil through the wires called "high-tension" cords. Note that there are one high-tension cord, from secondary winding to the center of the distributor cap, and four more high-tension cords between the spark plugs and the four terminals on the cap.

The resistor, connected in series to primary winding, serves to reduce the inductance of primary winding so that the high voltage generation in secondary winding will be stabilized.

NOTE:
Whereabouts of terminal connections are clearly indicated in the diagram below. When inspecting the electrical wiring, refer to this diagram and check to be sure that each connection is tight. Examine the cords for torn insulation and for evidence of grounding.

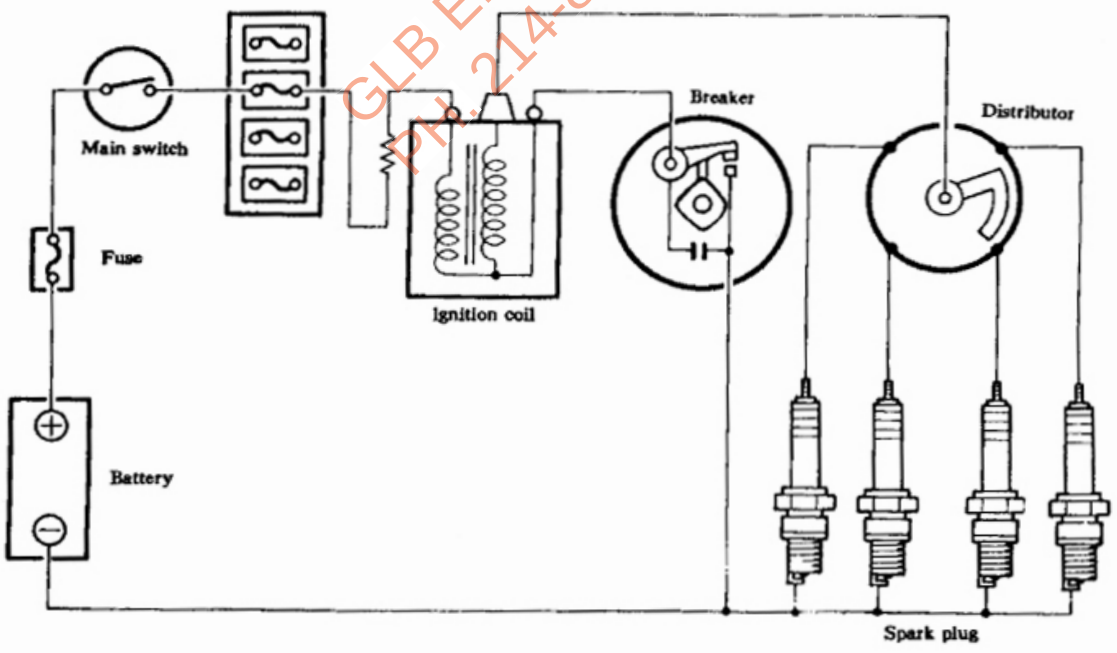


Fig. 8-1

Description of Components

Distributor

Fig. 8-2 shows the distributor unit in section to expose its internal mechanisms to easy viewing. The shaft is driven from engine crankshaft through worm gearing, and rotates once for every two revolutions of the crankshaft.

Inside the cap are four side electrodes (for spark plugs) and one center electrode (to which the secondary side of the ignition coil is connected). The arm of the rotor, mounted on the shaft, touches the side electrodes one by one "distribute" the high voltage to the spark plugs.

Immediately below the distributing mechanism is the contact-breaker, whose cam, mounted on the shaft, actuates the breaker arm to make and break the primary current circuit for the purpose already mentioned. The condenser (capacitor) secured to the distributor body is for absorbing the current surge, which would otherwise result in a sparking across the contact point gap. The surge occurs every time the contact point is opened, and is due to, so to say, the inertia of electric current. The object served by the condenser is obvious; it is to prevent the point faces from getting burnt by sparking.

The ignition is advanced automatically by centrifugal action and by the difference between inlet manifold vacuum and atmospheric pressure. How the advancer operates will be described in reference to Figs. 8-4, 8-5, 8-6 and 8-7.

Distributor data	
Cam dwell angle	52°
Condenser capacitance	0.25 microfarad
Ignition timing	10° B. T. D. C. /900r/min (rpm)
Number of gear teeth	13
Direction of rotation	Clockwise, as viewed from top

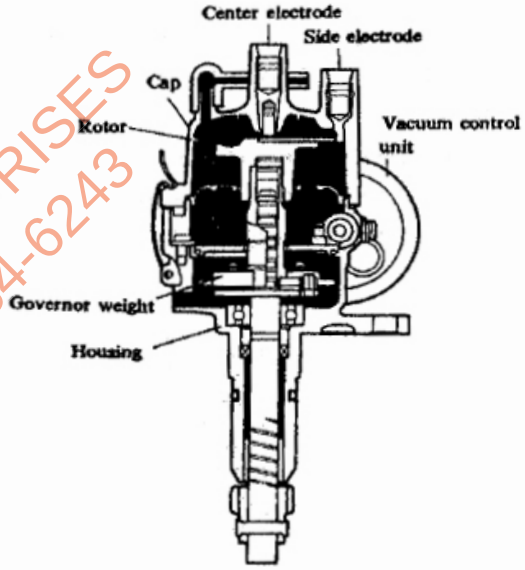


Fig. 8-2

Ignition coil

The ignition coil is a sort of minature transformer and, as such, has an iron core around which two coils are wound — primary and secondary windings mentioned above. The two are so close to each other that a sudden change in the magnetic flux produced by "primary current" flowing in primary winding (in a less number of coil turns) induces a very large electromotive force (voltage) in secondary winding (in a greater number of coil turns). These live parts are housed in a tight, insulator case topped by the cap

mentioned above. Note that the cap has three terminals; one high-tension terminal and two low-tension terminals.

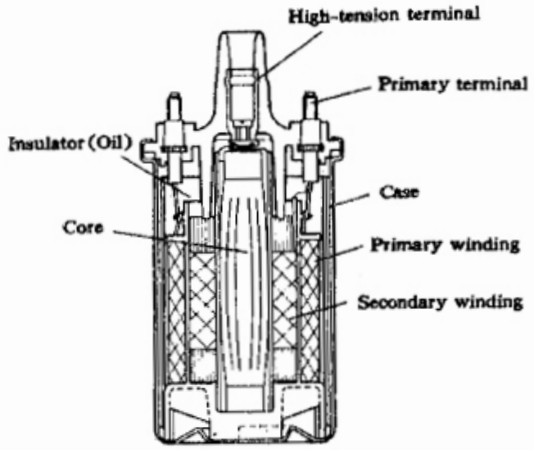


Fig. 8-3

Timing advancer

The distributor shaft, from its driven-gear end to the rotor-carrying end, is not a single solid piece; actually this shaft is in two pieces connected together through the timing advancer. The advancer is essentially a flyweight mechanism. Timing advancing action is accomplished by twisting the top shaft piece relative to the bottom one in the direction of shaft rotation.

The contact-breaker cam, mentioned above, for actuating the breaker arm is mounted on the top piece. The twisting movement is produced by the speed-dependent radial (or spreading) movements of the two flyweights.

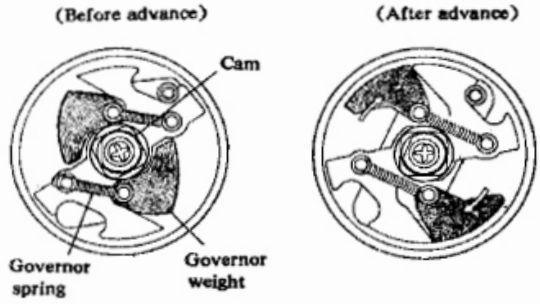
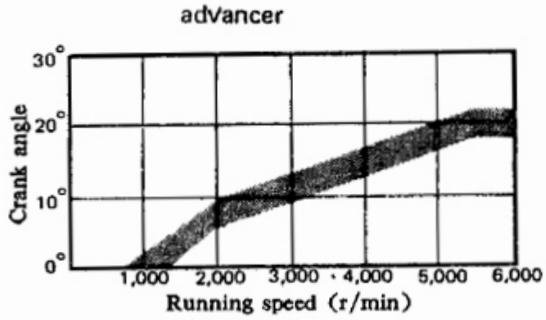


Fig. 8-4

Advancer feature



Vacuum advancer

When the engine is in lightly loaded condition, the amount of fuel being supplied to it is not much and, needless to say, throttle valve is open but a little, so that the vacuum in the inlet manifold side of the carburetor is high.

For fuel economy, it is desirable to advance the ignition when the engine is burning a small amount of fuel. The vacuum advancer utilizes the high vacuum to produce a force for actuating the advancer rod in order to angularly displace the breaker plate.

NOTE:
The vacuum advancer starts working to produce the advancing force when throttle valve is 4° to 5° open as measured from its fully closed position.

The diaphragm is spring-loaded. With a high vacuum, the differential pressure acting on the diaphragm causes to overcome the spring force and move in the direction for pulling the advancer rod. The rod so pulled turns the breaker plate counterclockwise (counter to the direction of distributor shaft rotation) to advance the ignition.

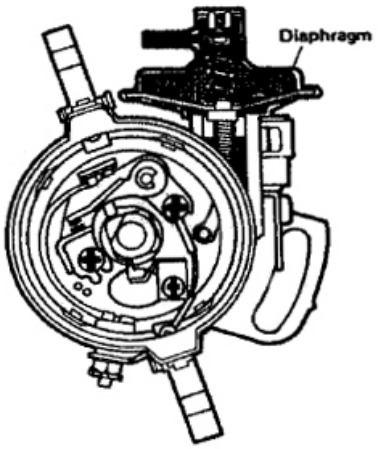
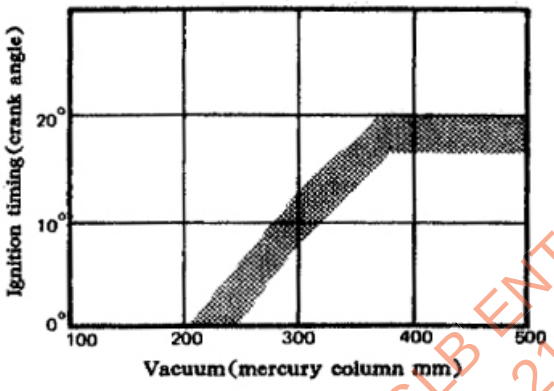


Fig. 8-6



Spark plugs

Each new machine shipped from the factory is fitted with standard plugs.

	Standard type
Nanjing Parking Plug Works	T4196J

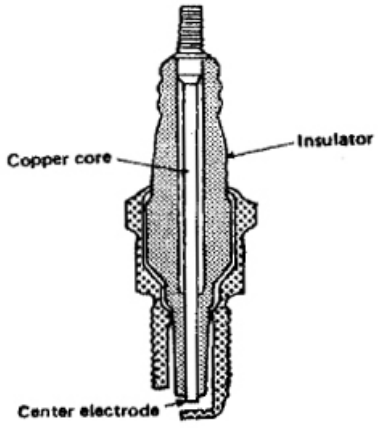


Fig. 8-8

Maintenance Services

Distributor cap

Leakage of high-tension energy for ignition shows up as misfiring in the engine. It occurs at any part of the high-tension line where insulation has failed or in a dirty distributor cap, that is, an internally dirty cap.

A wider spark gap in the plug, a conditin often found in poorly cared spark plugs, promotes the tendency of high-tension energy to find a short-cut to ground.

Cleanliness is very important for the distributor cap. With a clean dry cloth, wipe off dust or grime, if any, and inspect for any damaged (scarred, scratched or cracked) part or any part evidencing high-tension leakage inside the cap. Be sure to replace such parts.

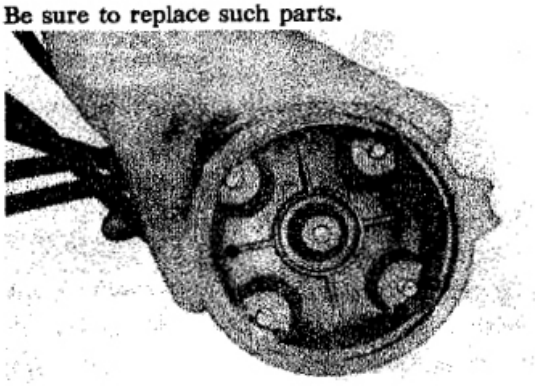


Fig. 8-9

Distributor driven gear

Inspect the gear teeth for wear, and see if the backlash is normal or not. Excessive backlash can be told by turning the shaft back and forth, with its driven gear in mesh with driving gear. Maladjusted ignition timing is often due to excessive tooth wear in this gearing and, in such a case, can be corrected by replacing the driven gear.

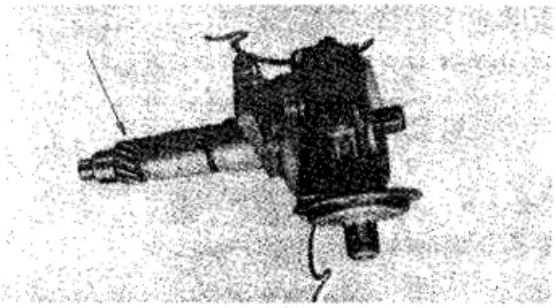


Fig. 8-10

Spark plugs

The spark gap specification is 0. 7 ~ 0. 8mm (0. 027~0. 031in). Be sure to use a thickness gauge in checking the gap. A wide gap is just as bad as a narrow gap. The 0. 7 ~ 0. 8mm (0. 027~0. 031in) gap will produce the right kind of sparks needed by the air-fuel mixture in this engine.

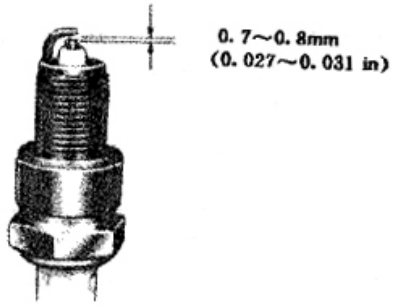


Fig. 8-11

Contact point faces

In the contact breaker, push the breaker arm with your fingertip just a little so that you can see the point faces. If the faces are oily, clean; if roughened, smoothen by grinding. In most cases, the point faces can be reconditioned by grinding with a file or oil stone. Points worn beyond repair must be replaced.

The illustration, below, tells what must be done in each case but the last one showing a pair of properly aligned, smooth faces. Wear or burning is hard to occur in the contact point whose point faces are in the condition labeled "good".

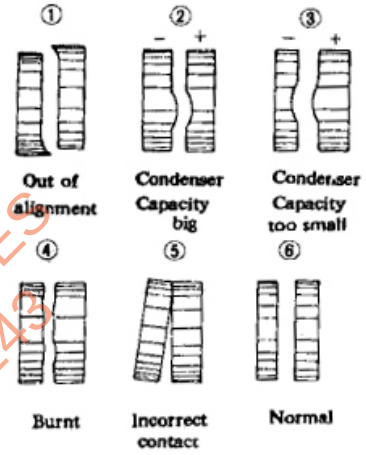


Fig. 8-12

Checking the primary circuit for fault

If the engine misfires or does not fire up at all where its spark plugs have just been checked to be in good condition, the first step of locating the cause is to check the primary circuit (between distributor and ground) for continuity by using a circuit tester as shown. Since the contact point is open, the tester should indicate discontinuity (infinitely large resistance); if continuity is noted, it means that there is a fault somewhere along the primary circuit, which could be in condenser or elsewhere.

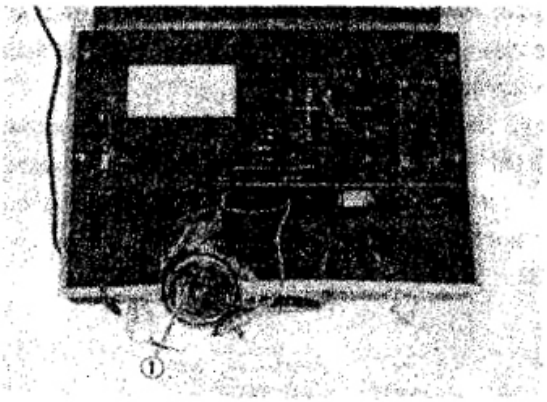


Fig. 8-13 ①*Open*

Condenser

Check the condenser for capacitance by using the electro-tester. You may do so with the condenser in place or removed. When checking it in place, that is ,as mounted on the distributor, be sure to have the contact point opened. A condenser not meeting the following capacitance specification must be replaced:

Condenser capacitance specification	0. 25 microfarad

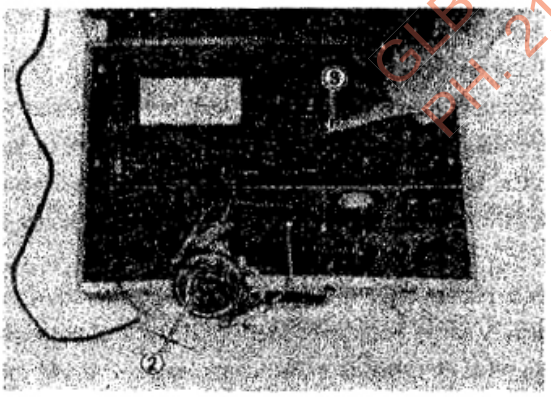


Fig. 8-14 ②*Open* ③*Push*

Ignition coil

(1)Sparking performance test

The purpose of this test is to see if the ignition coil is capable of producing high voltage surges forceful enough to fly good sparks at the ignition coils at all times, particularly when its temperature has risen to the normal operating level. Use of the electro tester is assumed for this test. With the ignition coil connected to the tester, as shown, let the spark fly across the three-needle gap. Continue this testing for about three minutes so that the coil will get warm to simulate the normal operating condition. The coil may be deemed to be in good condition if the sparking is stable, without any misses. In the use of the electro tester for this purpose, do not enlarge the three-needle gap wider than 7mm(0. 27in.)

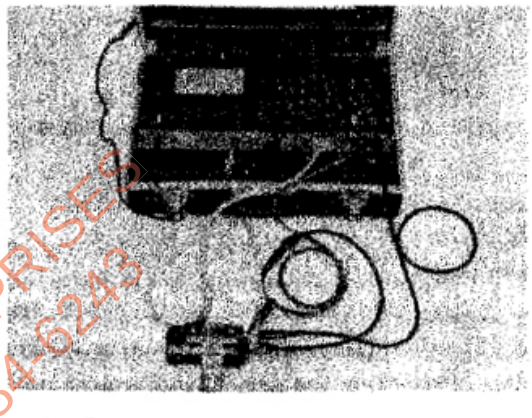


Fig. 8-15

(2)Resistance measurement

Measure the ohmic resistances of primary and secondary windings in the ignition coil. If the readings are in agreement with the prescribed values, indicated below, the coil may be judged to be in good condition. Take readings when the coil is hot, about 80℃(176℉); this is because we are interested in the performance of the coil at the normal operating temperature, not of a cold coil.

Primary winding resistance	About 3ohms (in clusive of the 1. 5ohm resistor)
Secondary winding resistance	About 8kilohms

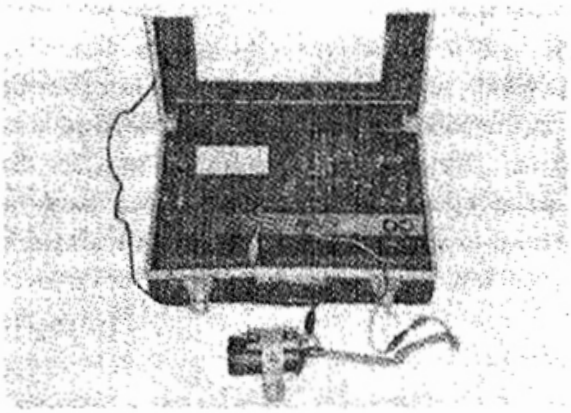


Fig. 8-16

Important Reminders for Reassembly and Installation

Distributor

When re-installing the distributor, be sure to insert it into the distributor gear case in the following sequence:

1) Turn over crankshaft in normal direction to index the (10° B. T. D. C.) timing mark ① to the timing match mark ②. The 10° mark is the one provided on flywheel. See Fig. 8-17. Normal direction of crankshaft is clockwise as viewed from front side.

CAUTION:
After aligning marks ① and ②, remove cylinder head cover to visually confirm that the rocker arms are not riding on the camshaft cams at No. 1 cylinder. If the arms are found to be riding on the cams, turn over crankshaft 360° to align the two marks anew.

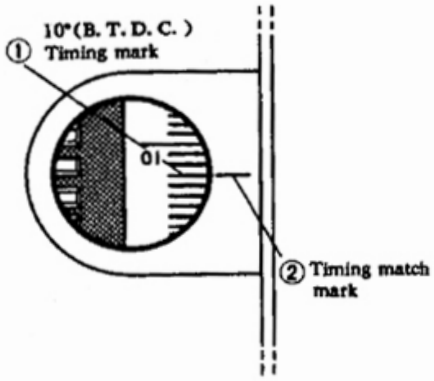


Fig. 8-17

2) Remove the distributor cap. Turn the rotor to make the center ③ of rotor flush with mark ④ embossed on the distributor housing, as shown in Fig. 8-18.

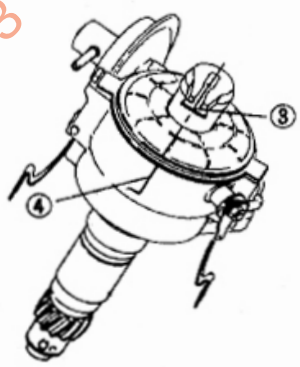


Fig. 8-18

3) Insert the distributor into the distributor gear case, indexing the embossed mark ⑤ of distributor flange to center ⑥ of the distributor mounting screw hole.

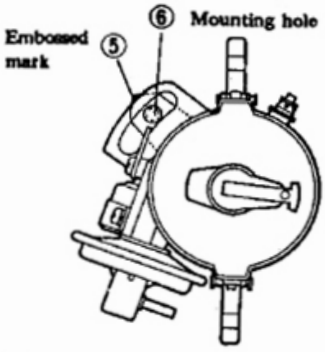
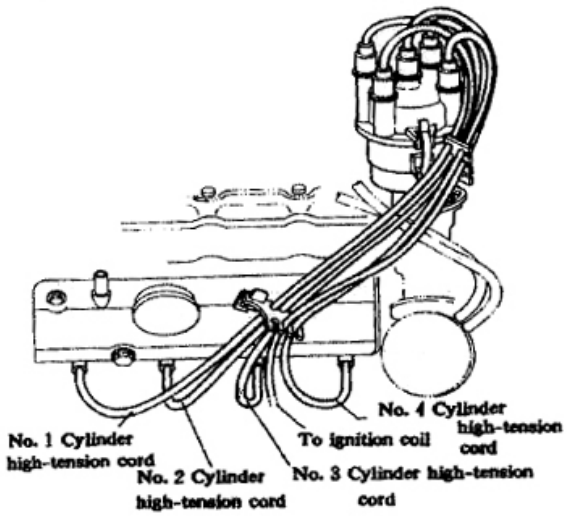


Fig. 8-18-1

High-tension cords

Install the four high-tension cords by referring to Fig. *8-19*, making sure to identify the four cap terminals of the distributor for the four cylinders.



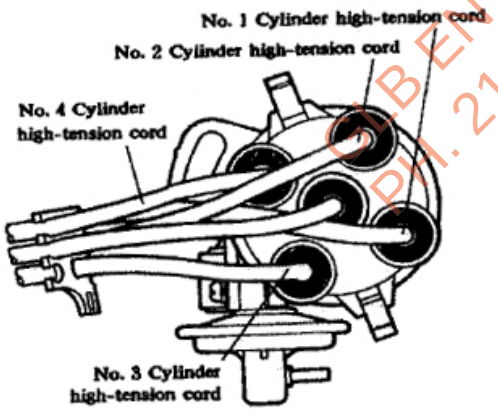


Fig. 8-19

Ignition Timing

Specifications

Ignition timing	10° B. T. D. C. at 900r/min (rpm)
Ignition order	1→3→4→2
Breaker point gap③	0. 4～0. 5mm (0. 016～0. 019in.)

Checking methods

Check to be sure that the point gap is within the specified range, from 0. 40 to 0. 50mm (0. 016 ～0. 019in.) and then check the ignition timing on No. 1 cylinder. To adjust the point gap, loosen screws ① and move the stationary point with plain screwdriver inserted into slit ②.

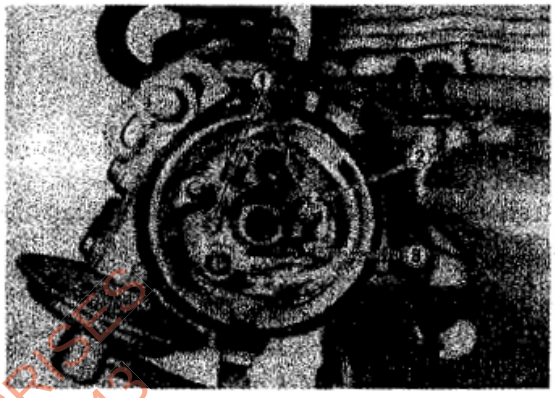


Fig. 8-20

(1) Checking and adjusting with timing light

CHECKING:

Tie the light to No. 1 high-tension cord. Start up the engine and run it at 900r/min. Under this condition, direct the light to the flywheel. If the 10° timing mark ④ appears aligned to the timing match mark ⑤, the ignition is properly timed. See Fig. 8-22.

Fig. 8-21

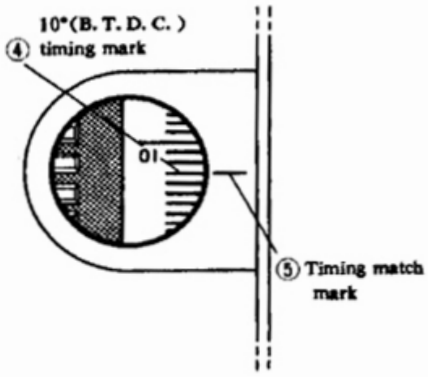


Fig. 8-22

ADJUSTING:

If the mark ④ is off the mark⑤, adjust the timing as follows:

1) Check to be sure that breaker point gap is between 0. 4 and 0. 5mm (0. 016 and 0. 019in.).

2) Loosen the distributor clamp bolt and turn the distributor housing in place to advance or retard the timing.

NOTE:

- Turning the housing counterclockwise advances the timing, and vice versa.
- After repositioning the housing, check the timing with the timing light and, as necessary, repeat step 2).

(2) Checking and adjustment with the timing tester

The timing tester has a built-in buzzer.

Connect one of its leads to the primary-circuit terminal of the distributor and the other lead to the distributor body. Slowly turn the crankshaft by rotating the cooling fan clockwise while watching the timing marks. (have the ignition switch turned off.)

The buzzer should start sounding off just when the marks come into register, indicatiog that the engine is set for the specified timing.

CAUTION:

With timing marks ⑥ ⑦ lined up as shown in Fig. 8-23, remove the cylinder head cover and check to be sure that No. 1 cylinder rocker arms are not riding on cam lobes. If the arms are up, turn over crankshaft by one rotation (360°) clockwise (as viewed from front side). This turning should cause the buzzer to sound off just when the marks come into alignment.

NOTE:

The two tester leads are given polarity signs, (+) to one and (−) to the other lead; connect the red lead to (+) cord, and the black lead to (−) cord, of the distributor.

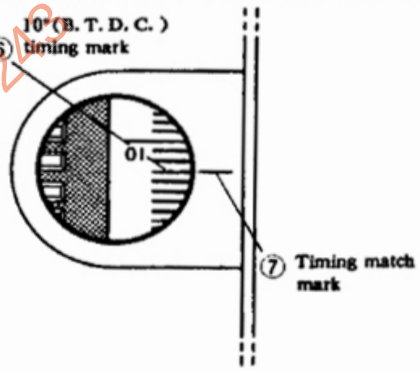


Fig. 8-23

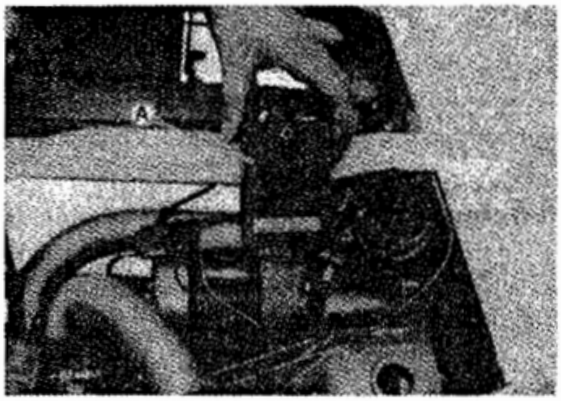


Fig. 8-24 Timing tester

ADJUSTING:

Upon noting that the ignition is not timed to the

specification, proceed as follows:

1) Make sure that the breaker point gap is set right, that is, between 0. 4 and 0. 5mm (0. 016-0. 019in.).

2) Bring timing mark ⑥ into alignment with mark ⑦, as shown in Fig. 8-23. Mark ⑥ represents the 10° crank angle.

3) Loosen the distributor clamp bolt, and slowly rotate the distributor housing until the buzzer starts sounding off. Hold the distributor right there and tighten the clamp bolt.

NOTES:

1. **Turning the housing counterclockwise advances the timing and vice versa.**
2. **After tightening the clamp bolt, check the timing once again.**

Checking the timing advancer action

①CENTRIFUGAL ADVANCE:

Hook up the timing light, disconnect the vacuum hose from the vacuum advancer. Check that the ignition advancer increase up its speed as shown in Fig. 8- 4. If not, that means something is wrong with the advancer. The controller return spring cracked or weekened or load bonded results in this problem.

Note:

When ignition timing is in conformity with the readings in Fig 8- 4, add 10° to the readings (in static ignition).

②VACUUM ADVANCE:

Connect the vacumm hose again, run the engine without load. Check the flywheel timing mark with the timing light.

a. When the engine runs at 3, 500r/m, read out the timing value according to the crank angle.

b. When the engine runs at the speed stated above, remove the vacuum hose from the carburetor, read out another reading. The difference between the first reading and the second one is the advance angle.

Note:

If the first reading is mostly the same as the second one, it means the vacuum advance is wrong.

Note:

Before checking the vacuum advance, be sure no leakage, crack, and damage of the vacuum hose.

Repalcement of Distributor Drive Gear

Replacing a worn-down driven gear (a part of the distributor assembly) is not enough. Inspect the drive gear, too, and replace it if it is badly worn down. The drive gear can be removed from the camshaft.

Worn gears in the distributor drive are likely to disturb the ignition timing and must be replaced.

When pressing the replacement drive gear onto camshaft, be sure to position the gear angularly as shown in Fig. 8-25. Note that the tooth root is radially centered on the center line through the keyway provided in camshaft.

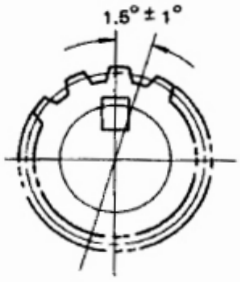
NOTES:

1. **Before removing the drive gear from the camshaft, scribe a match mark on this shaft and, when mounting the replacement drive gear, refer to this mark.**
2. **There is no need to discriminate between the two end faces of the drive gear: the gear may be fitted with either end held foremost.**

CAUTION:

Distributor gear case

Where the distributor gear case has been removed in engine disassembly or at any other occasion, be sure to fill up the case with 60cc (2. 03/2. 11 US/Imp oz) of engine oil after re-installing the case. Never start up the engine with the gear case empty of oil.



Front side view

Fig. 8-25

SECTION 6G

STARTER MOTOR

CONTENT

Description

A shift-lever type starter motor is used for cranking the engine. The motor is mounted on the crank case, with its drive pinion meshed with the ring gear of the flywheel. In the following illustration, note that the whole motor assembly inclusive of the magnetic switch and lever mechanism is enclosed.

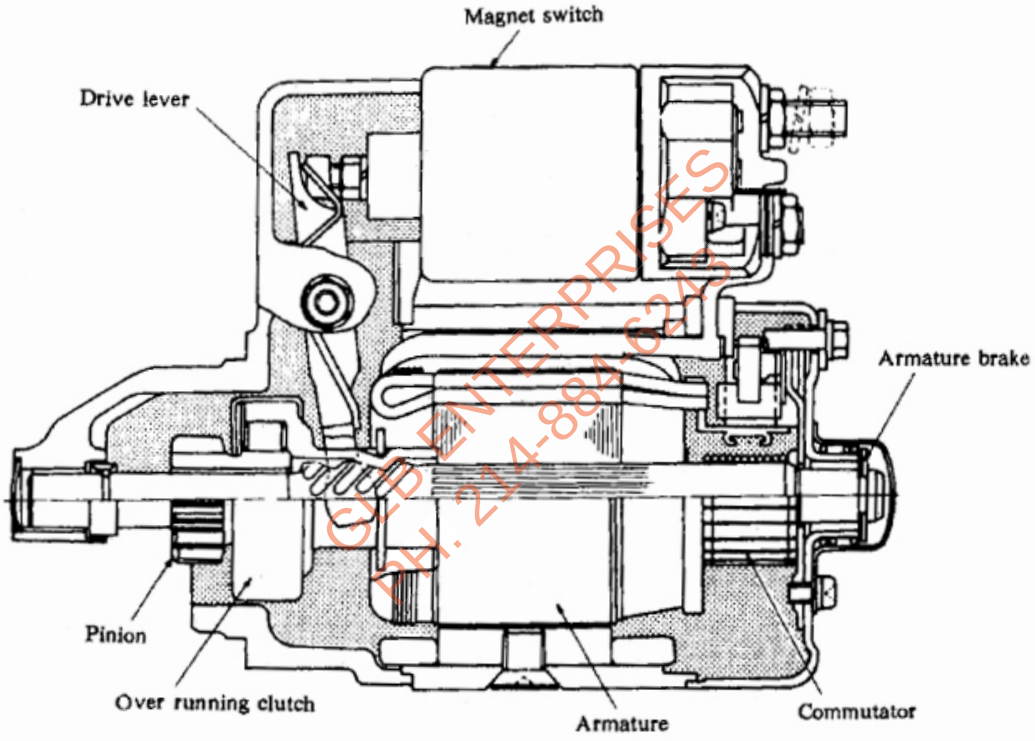


Fig. 9-1

Specifications

Voltage	12volts
Output	0. 8kw
Rating	30seconds
Direction of rotation	Counterclockwise as viewed from pinion side.
Brush length	19mm(0. 75in.)
Number of pinion teeth	8
No-load characteristic	50A maximum at 11 volts, 5, 000rpm minimum
Load characteristic	270A maximum at 9. 5 volts and 0. 7 kg-m torque, 1, 200 rpm minimum
Locked rotor current	600A maximum at 7. 7volts, 1. 3kg-m minimum
Magnetic switch operating voltage	8volts maximum

Cranking Action

Starting up the motor

Turning on the starting switch results in a small current flowing through the holding coil and another through the pull-in coil, both in the magnetic switch. The former current flows direct into ground, but the latter flows through motor armature and field. In other words, motor begins to run. In the magnetic switch, the two coils energized—pull-in coil and holding coil—develop a combined magnetic pull, by which the moving core is pulled against the force of the spring and moves toward the right (in the illustration). At this time, the motor armature is running but slowly because of the small initial current. As the moving core is forced toward the right, its left end turns the shift lever around its pivot, so that the bottom end of the lever pushes the clutch toward the left. Since the clutch is splined to the motor shaft and because the motor shaft is rotating, the clutch advances toward the left as assisted by the helical splines.

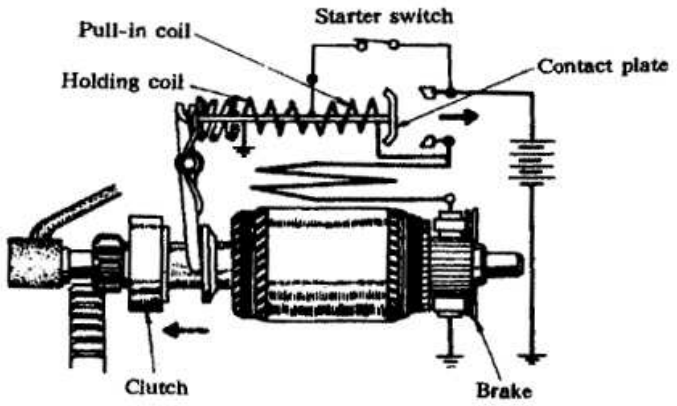


Fig. 9-2

Pinion meshing with the ring gear

The pinion may mesh into the ring gear smoothly or may bounce on the ring gear , depending on the relative positions of their teeth. In the latter event, the springs mounted on the clutch absorb the shock and, since the pinion is rotating and being pushed, its teeth will eventually mesh into those of the ring gear. In either case, the shift lever is allowed to turn fully and permit the moving core to be kept pulled all the way toward the right. When this happens, the main contactor of the magnetic switch closes to connect the starter motor direct to the battery. Consequently, a very large current—load current—flows through the motor to develop a normal cranking torque for driving the engine crankshaft through the drive pinion and ring gear.

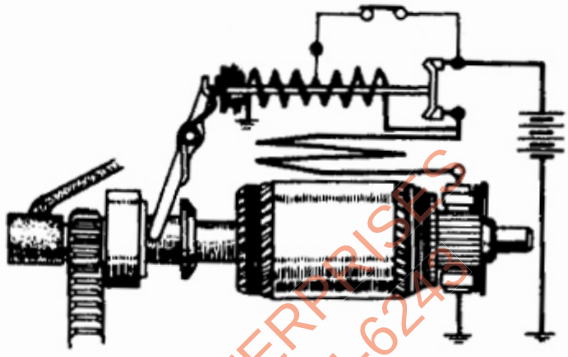


Fig. 9-3

Engine cranking

When the motor is cranking the engine with full force, the pull-in coil is bypassed or shunted but the holding coil remains energized to hold the moving core in its shifted position. Under this condition, the shift lever is pushing the pinion by overcoming the force of springs.

As the engine fires up and begins to run steadily and if the starting switch is kept closed, the ring gear starts driving the pinion. When this occurs, the pinion merely spins on the motor shaft without transmitting this reverse drive to the motor. This is because the clutch is of overrunning type.

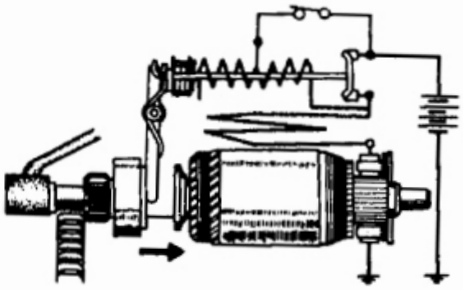


Fig. 9-4

Terminating cranking operation

Turning off the starting switch de-energizes (shutting off the current) the holding coil so that the pull hitherto acting on the moving core disappears. By the force of the spring, then, the shift lever is turned back and the moving core is forced toward the left to open the main contactor. This shuts off the load current, and the drive pinion, shift lever and moving core go back to their original positions.

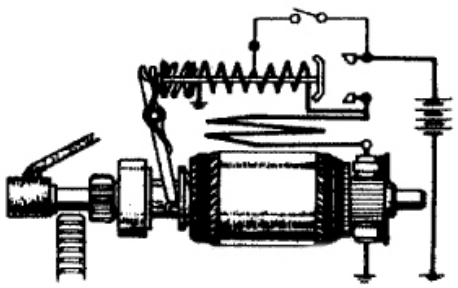


Fig. 9-5

Removal

1) Disconnect battery cable from the negative (-) terminal of the battery.
2) Disconnect the plus cord (+) and white/brown lead wire from the starter motor.
3) Remove the two bolts securing the starter motor assembly to the crank case, and take off the starter motor.

Disassembly

1) Remove the nut securing the end of the field coil lead to the terminal on the head of magnetic switch.
2) Take off the magnetic switch ① from the starter motor body by removing the two mounting screws.

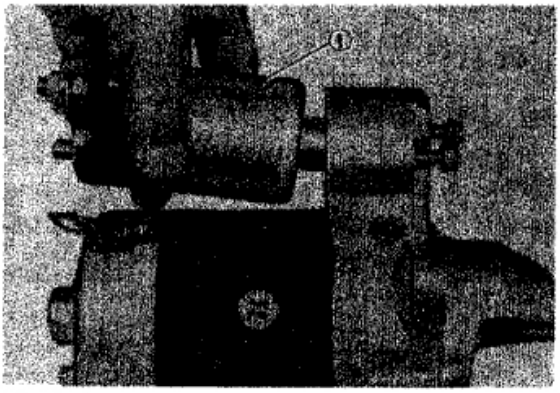


Fig. 9-6

3) Remove the bearing cover ② and take out lock plate brake spring ③ and rubber ④.

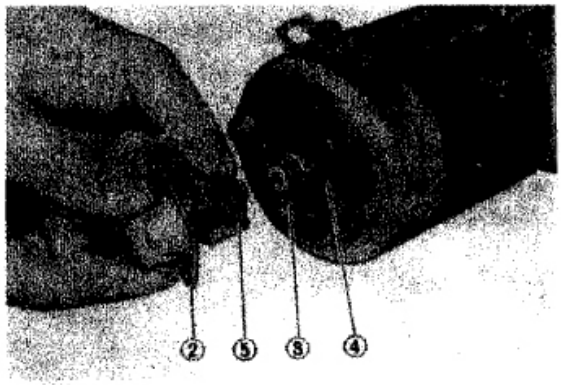


Fig. 9-7 ⑤ *Clip*

4) Disassemble the brush holder section in the following sequence:
   (1) Remove two through bolts.
   (2) Detach commutator end frame.
   (3) Draw brushes out of the holder.

(4)Take out the brush holder.

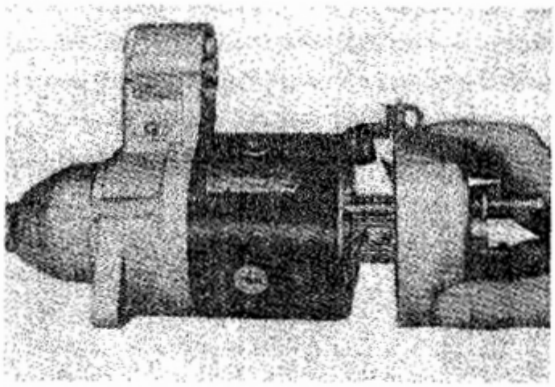


Fig. 9-8

5)Remove the case complete with field coils.
6)Pull off the set pin from shift lever, and take out the rubber and plate inside the housing.
7)From the housing, take out the armature, starter clutch and shift lever.

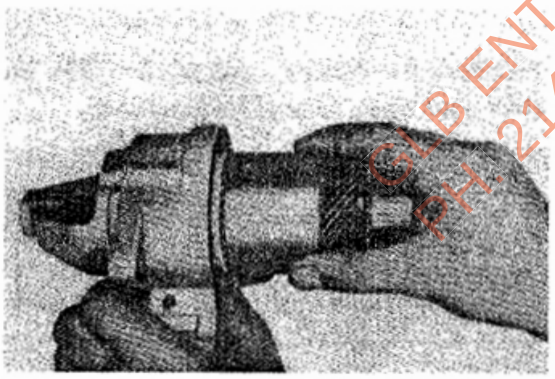


Fig. 9-9

8)Draw off the starter clutch, as follows:
(1)Draw stop nut toward the clutch side.
(2)Remove snap ring and slide off clutch.

Maintenance Services

In the event the starter motor is found unable to crank the engine, the first thing to be checked is whether the drive pinion plunges out. If the pinion does not plunge out, then the magnetic switch must be checked.

If the pinion plunges out satisfactorily, then the inability of the motor to crank the engine is likely to be due to some defective condition in the commutator or in the armature, provided that the battery is in good condition and that the circuit for applying the battery voltage to the motor is free from any open or fault. Having narrowed the scope of search for the cause of trouble to the motor proper, proceed as follows:

Checking the field coils

Check to be sure that the field circuit is neither grounded or open-circuited. This can be effected by using a circuit tester as shown. If continuity is indicated by the tester hooked to the housing or frame, it means that the insulation has failed, resulting in a grounded field coil. Such a fault can be corrected by repair in most cases.

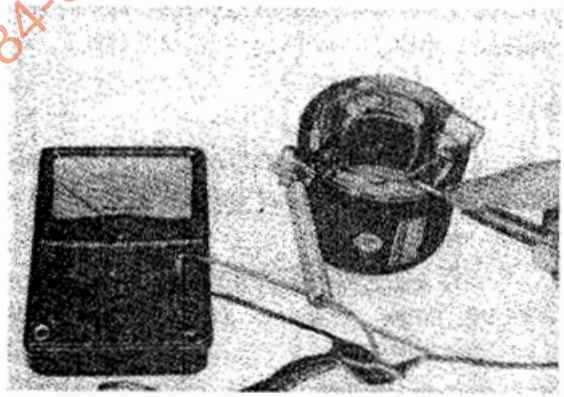


Fig. 9-10

Checking the armature

• Using the circuit tester, see if there is any continuity between commutator and armature core. The tester will indicate infinite resistance if the insulation is in sound condition.

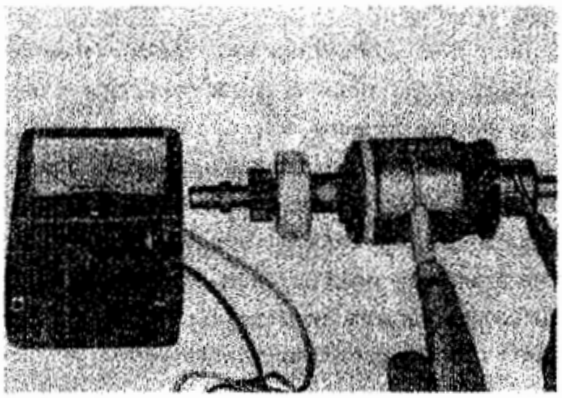


Fig. 9-11

- Again using the tester, check for continuity between each pair of adjacent commutator segments. If discontinuity is noted at any part of the commutator, replace the whole sub-assembly of the armature.

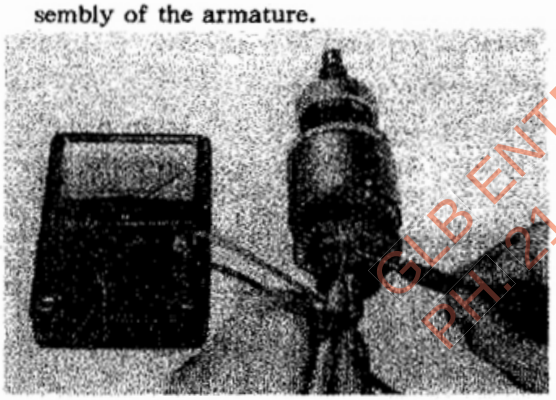


Fig. 9-12

Servicing the commutator

- If the surface of the commutator is gummy or otherwise dirty, wipe it off with a cloth dampened with gasoline. If the surface is coarsened or in burnt condition, smoothen it by grinding with sandpaper. If the surface is grooved deep, it may be necessary to remove the groove marks by turning the commutator in a lathe; such turning is often successful in reconditioning the commutator if the extra stock necessary for removal by cutting is available without reducing its diameter to the limit.

	Standard	Service limit
Commutator diameter	32. 5mm (1. 28in.)	30. 5mm (1. 20in.)

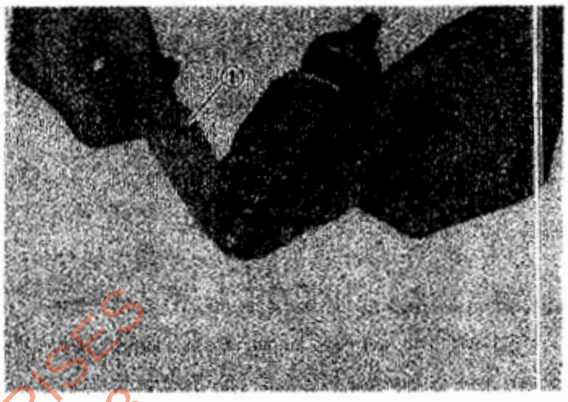


Fig. 9-13 ①Sand paper

- Make sure that the mica between each pair of adjacent segments is undercut to the prescribed depth. The conventional undercutting technique is to be used in repairing the commutator.

	Standard	Service limit
Mica undercut	0. 5～0. 8mm (0. 02～0. 03in.)	0. 2mm (0. 007in.)

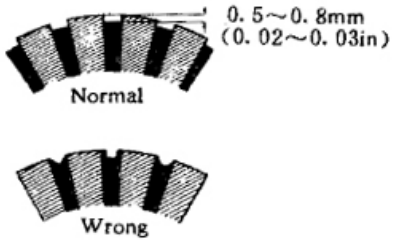


Fig. 9-14

Testing the magnetic switch

Before separating the magnetic switch from the motor proper just removed from the crankcase, test the switch by connecting the battery to the switch, as shown, to see if the drive pinion jumps out when the battery voltage is applied. (With the positive terminal of the battery cable end.) With the switch coils in sound condition, the drive pinion will jump out and, even when the main circuit is opened at "A", will remain in "jumped out" position. If undoing the connection at "A" causes the drive pinion to retract, it means that the holding coil is defective.

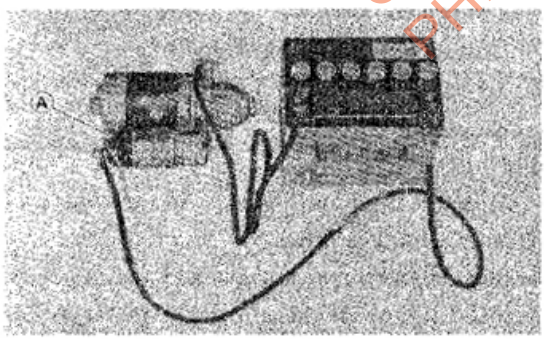


Fig. 9-15

Servicing the brushes

Check the length of each brush. If brushes are worn down to the service limit, replace them.

	Standard	Service limit
Brush length	19mm (0.75in.)	12mm (0.47in.)

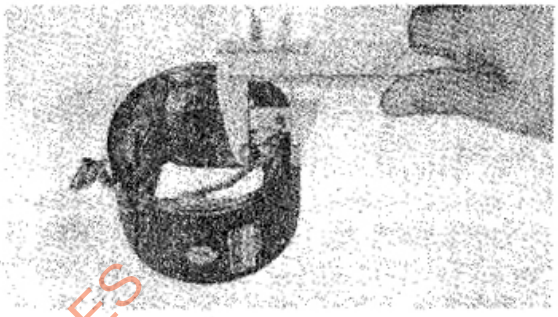


Fig. 9-16

Servicing the brush holders

Make sure that the insulation between the two brush holders, positive and negative, is in good condition. This should be verified with the use of the circuit tester. If any continuity is noted, repair the insulation.

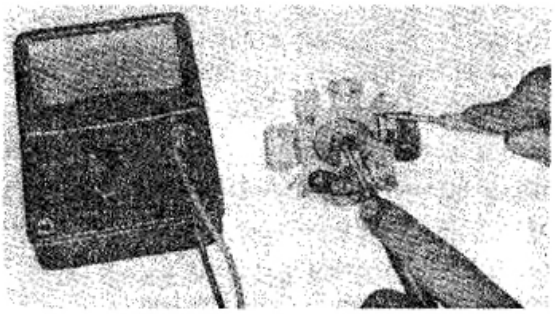


Fig. 9-17

Important Reminders for Starter Motor Reassembly

Various parts of the starter motor assembly need lubrication at each overhaul. The lubrication points are illustrated below; (Also required is locking by punching.)

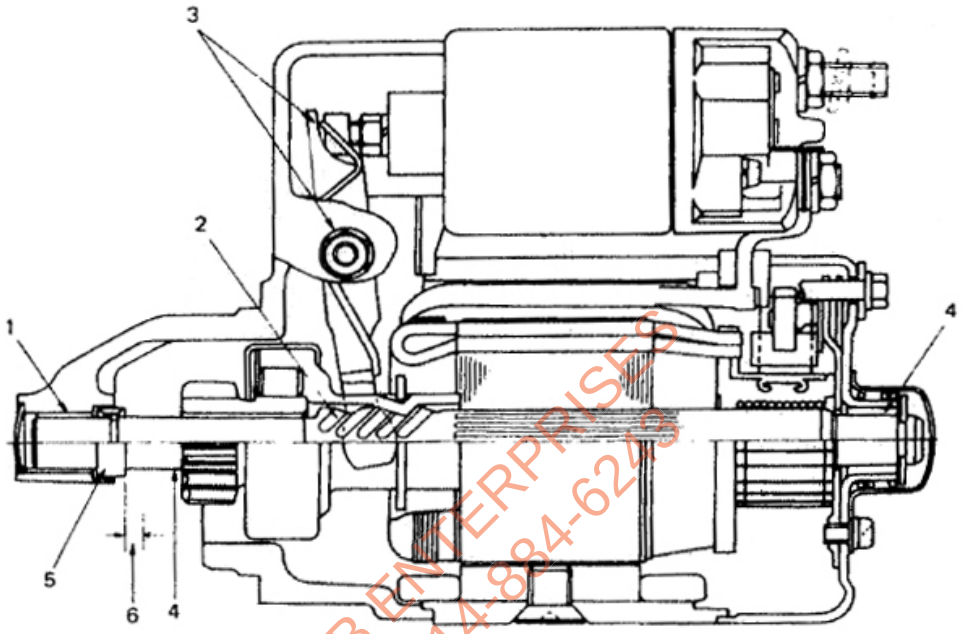


Fig. 9-18

1)Give grease to the bush in the drive housing.
2)Grease the helical splines before mounting the clutch sub-assembly.
3)Grease the sliding or contacting surfaces associated with shift lever.
4)Grease the bush fitted into the end frame and also the armature shaft end inserted into this bush.
5)After installing the stop nut, lock it by staking at two places with a punch.
6)Adjust the length of the moving stud so that the clearance between the stop nut and the pinion in plunged-out condition will be from 1 to 4 mm(0. 04 to 0. 16in.). To check, run the motor in no-load condition to plunge out the pinion and wait till the motor speed settles.

SECTION 6H

CHAARGING SYSTEM

CONTENT

Description

The charging system consists of the alternator complete with a means of rectification for producing DC output power, and the two-element regulator unit for controlling the voltage.

In the alternator, the armature is stationary; it consists of three coils mounted-on the stator in such a way as to produce three-phase alternating voltage. This voltage applies to the rectifier for full-wave rectification. The rectifier delivers power in the form of direct current.

Against the stationary armature, revolving magnetic fields are produced by the field winding carried in the rotor. This feature of construction of the alternator strikes a distinct contrast to the dynamo (DC generator), in which the field is in the stator while the armature is in the rotor.

The magnitude of three-phase AC power available from the alternator to its rectifier is directly proportional to rotor speed and field (excitation) current. It is the function of the regulator unit to control the field current automatically in such a way that the output voltage unit to control the field current automatically in such a way that the output voltage remains constant; another function is to control the circuit of the charge warning lamp. Thus, the regulator unit has two element; one is voltage regulator for performing the first function and the other is voltage relay for the second function.

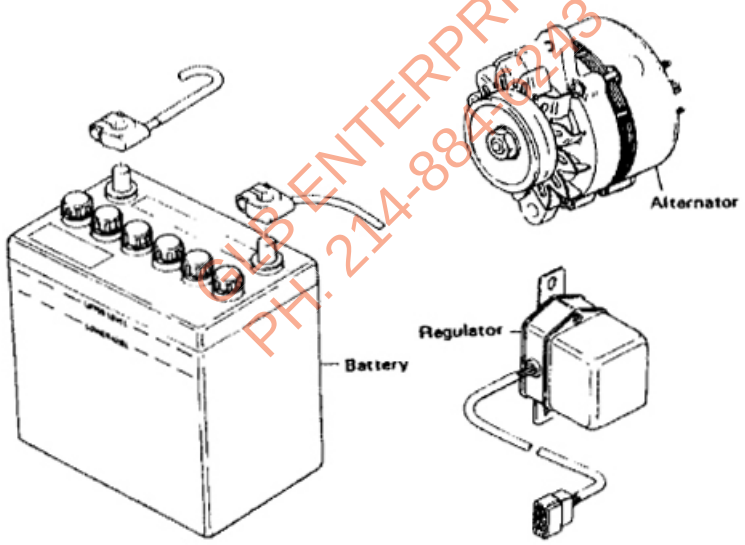


Fig. 10-1

Charging Operation

The following description of the system operation is referenced to the circuit diagram indicated in Fig 10-2. Closing the ignition switch connects the charge warning lamp to the battery; a small current flows through the lamp, lighting this lamp to signify that the alternator is not charging the battery, and through the contact point of voltage relay to ground. Another current flows from the battery through the contact point of voltage regulator into the field winding in the alternator rotor, thereby producing magnetic fields around the rotor. These fields, which are stationary at this time because the rotor is not

running, link the armature coils and the rotor poles through the air gap between stator and rotor.

Under these conditions, suppose the engine is started up. The rotor begins to run, and its magnetic fields revolve to "cut" the three armature coils in succession. In each armature coil, an electromotive force is generated by electromagnetic induction. This force changes its direction alternately. Consequently, the three armature coils apply three alternating voltages to the rectifier. Viewed collectively, these voltages constitute the three-phase output voltage of the alternator.

The rectifier consists of three pairs of rectifying diodes, forming three one-way paths of current for full-wave rectification to convert the alternator output power into a direct current power, which is available from the "B" terminal of the alternator-rectifier unit, relative to "E" (ground) terminal.

As the engine picks up speed, the electromotive force induced in each armature coil increases, so that the output voltage appearing at terminal "B" (relative to terminal "E") becomes high enough to "push" electricity into the battery through its positive terminal. In other words, the battery begins to draw a charging current.

Let' s take a look at the pressure coil of the voltage relay. One end of this coil is connected to terminal "E" and the other end to the neutral point "N" of the three armature coils. Potential level of "E" (ground) is now so much lower than that of "N" that a current flows in the pressure coil to develop a magnetic pull. Consequently, point "P5" separates from point "P4" and touches point "P6"; the charge warning lamp thus becomes shunted and stops burning to signify that the battery is getting charged.

During the early stage of engine starting, the alternator output voltage may be lower than the battery voltage; even in such a case , no current flows from the battery into the alternator because of the rectifier diodes. The reason why a cutout relay is not used here is explained by the presence of the diode rectifier.

The function of the voltage regulator with its voltage coil is to alter the path of field (excitation) current for the field coil, in order to maintain the alternator output voltage at a relatively constant level. When this voltage rises owing to a rise in engine speed, the voltage coil pulls point "P2" away from point "P1", thereby introducing the control resistor "R1" into the field circuit. Field current falls slightly because of this resistance and , consequently, the output voltage falls to the normal level. If the engine picks up speed further, the magnetic pull developed by the voltage coil increases to bring point "P2" into contact with "P3", thereby shunting the field coil to reduce the field current to zero. Under this condition, voltage generation in the alternator is dependent on the residual magnetization of the rotor, which is small enough to keep down the output voltage to the normal level.

The foregoing description of the voltage regulator operation may be summarized as follows; the regulator controls the alternator output voltage by controlling the field current in three steps; first allowing a full field current to flow; secondly, by inserting a resistor into the circuit to reduce the field current; and thirdly, by shunting the field coil to reduce the current to zero.

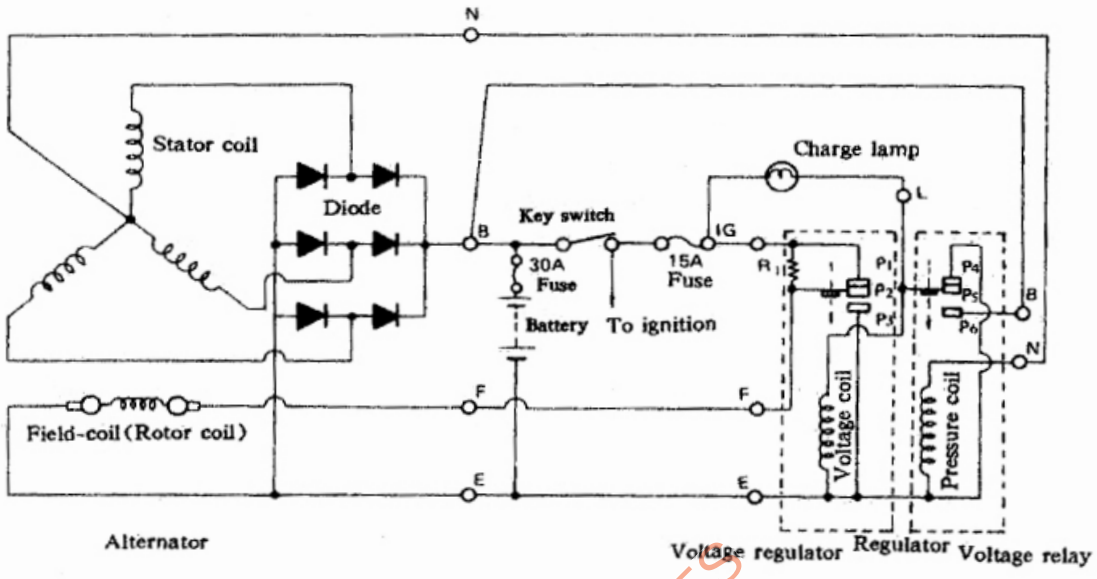


Fig. 10-2

Alternator

Description

In order to distinguish it from conventional automotive dynamos, the AC generating device is called an alternator for it produces a DC output from three alternating currents generated in its winding.

The alternator consists of; the rotor (which produces revolving magnetic fields), stator (which is a series of coils disposed and arranged to form three coil groups), two slip rings and two brushes (through which DC excitation current is fed into the field winding of the rotor), and the rectifier (which consists of six semiconductor diodes, and is built in the alternator).

In operation, the revolving magnetic fields "cut" the stator coils. In other words, the three groups of coils experience changes in magnetic flux. By the flux changes, an alternating electromotive force (emf) is induced in each coil group. Thus, three alternating voltages are available from the stator.

The six diodes are arranged so that they "rectify" or convert the three alternating outputs into a DC output. Three-phase full-wave rectification is effected by the built-in rectifier.

In terms of electric current, a diode is a circuit element that passes the current only in one direction. Of the six diodes, three are arranged to pass currents in the same direction, and the remaining three in the opposite direction. Since three alternating currents undergo full-wave rectification and are combined into one by superposition and are combined into one by superposition, the DC output of this alternator is much steadier and carries much less pulsating or ripple components than a DC output made available by full-wave rectification of a single-phase alternating current.

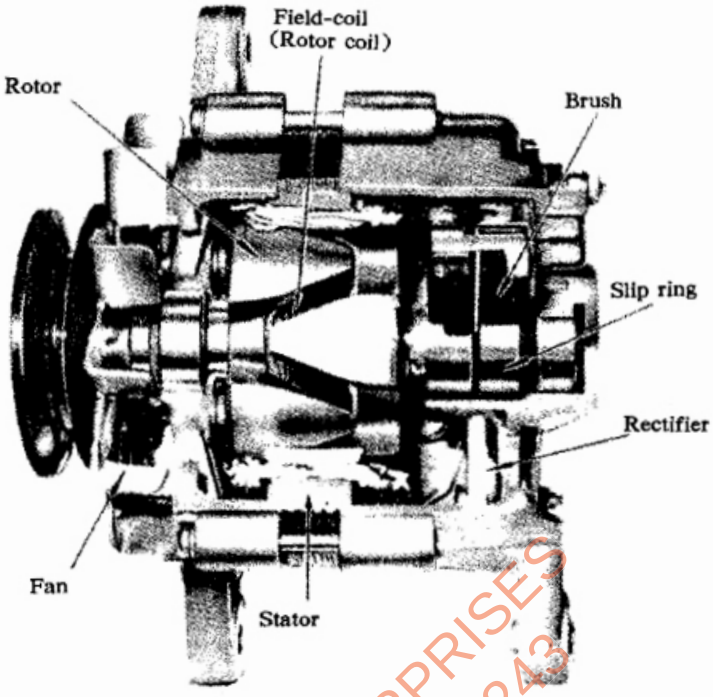


Fig. 10-3

Data and Specification

Nominal operating voltage	12Volts
Maximum alternator output	35A
Polarity	Negative ground
Effective pulley diameter	65mm(2. 56in.)
No-load alternator speed	1,050～1,250rpm, 14 Volts at normal temperature
Full-load alternator speed	4, 000rpm maximum, 35A, 14 Volts at normal temperature
Direction of rotation	Clockwise as viewed from pulley side
Maximum permissible alternator speed	13,000rpm
Working temperature range	-40°C～80°C (-104°F～176°F)
Rectification	Full-wave rectification

Removal

(1) Disconnect the negative battery cable from the battery.

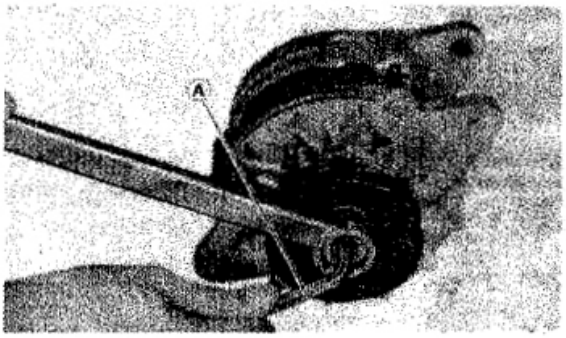
(2) Disconnect from the alternator the red cord and circuit coupler.

(3) Remove the bolts securing "V" belt adjusting arm and alternator and take down the alternator.

Alternator Disassembly

Remove the nut securing the fan to the rotor shaft. To do so, the shaft must be held rigid and steady by using a special tool Ⓐ.

Hexagon wrench, 6mm



Fig, 10-4

Remove the 3 bolts fastening the end frame to the rotor housing; tap on the edges of the end frame with a wooden mallet to separate it from the housing, thereby severing the rotor from the stator.

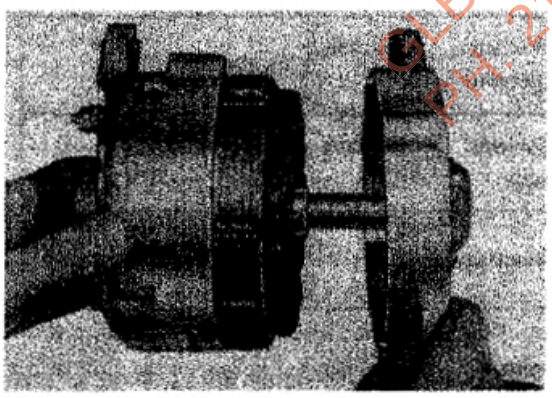


Fig. 10-5

Draw out the rotor. It may be necessary to lightly tap on the core and housing.

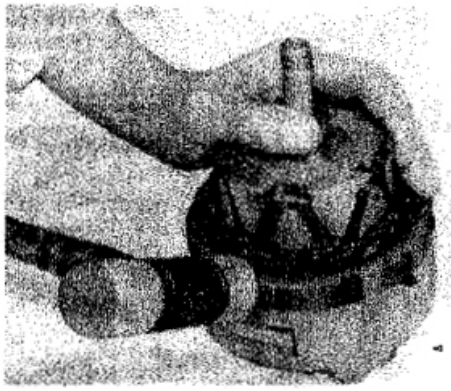


Fig. 10-6

Remove the 3 nuts securing the rectifier holder in place, and one other nut holding down the terminal insulator. Remove the rear end cover.

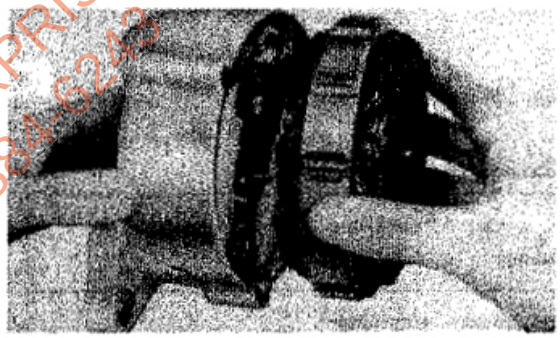


Fig. 10-7

Remove the brush holder from the stator.

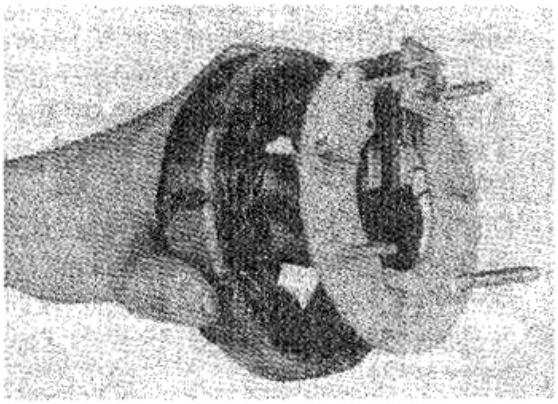


Fig. 10-8

NOTE:
The alternator is to be reassembled by reversing the foregoing sequence of steps. Before inserting the rotor into the housing, be sure to have the brushes installed in the holder. (Use a propersize rod Ⓐ, manipulating it from the rectifier side, to set the brush in the holder.)

Fig. 10-9

Maintenance Services

(1)Rotor

• Testing the rotor for open-circuit

Check to be sure there is continuity between the two slip rings when tested as shown. Absence of continuity means that the field coil is open-circuited and must be replaced.

Ring-to-ring circuit resistance	4～5ohms

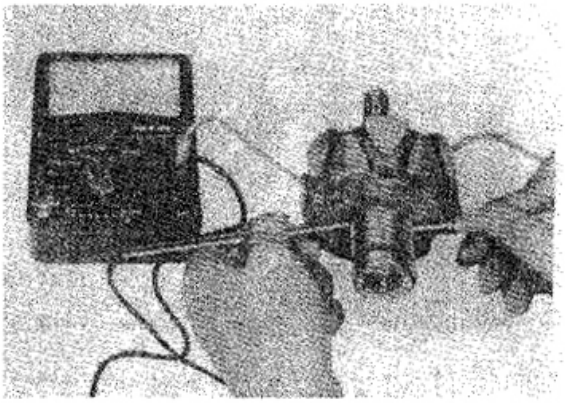


Fig. 10-10

• Testing the rotor for grounding

Check to be sure there is no continuity between the slip ring and the rotor shaft when tested as shown. Presence of any continuity means that the insulation on the field coil has failed, making it necessary for the rotor to be replaced.

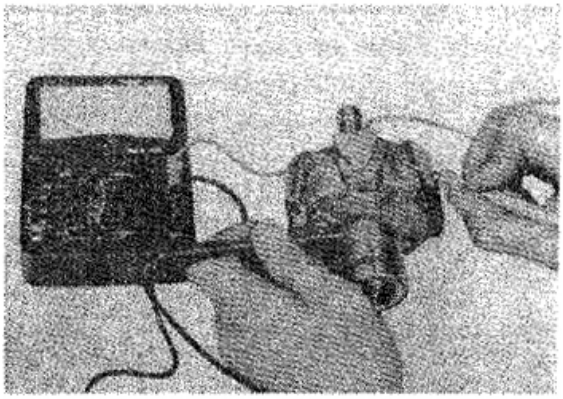


Fig. 10-11

(2)Stator

Check to be sure there is no continuity between the stator core and each armature coil; any continuity noted means that the coil is grounded. A grounded armature coil can be

corrected by locating the faulted point and repairing the fault.

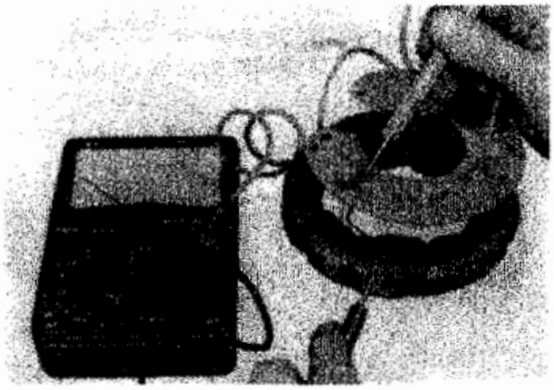


Fig. 10-12

(3)Brushes

Check each brush for wear by measuring it length, as shown. If the brush is found worn down to the service limit, replace the brush and holder altogether.

	Standard	Service limt
Brush length	16.5mm (0.65in.)	11.0mm (0.45in.)

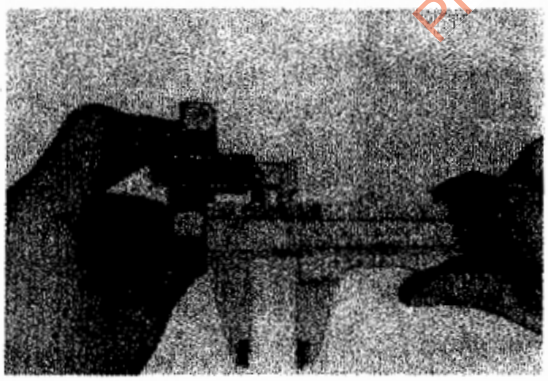


Fig. 10-13

(4)Rectifier

The rectifier is to be checked with the ohmmeter for continuity in one direction and non-continuity in the other direction.

Put ohmmeter lead to terminal "B" and the other lead to terminal "N"; then swap the two leads. Of the 2 ohmmeter indications, one should be about 20 ohms, meaning continuity, and the other should be infinity (non-continuity).

Put ohmmeter lead to terminal "N" and the other lead to terminal "E"; then swap the two leads. In this case, too, the two ohmmeter indications should be similar to those mentioned above.

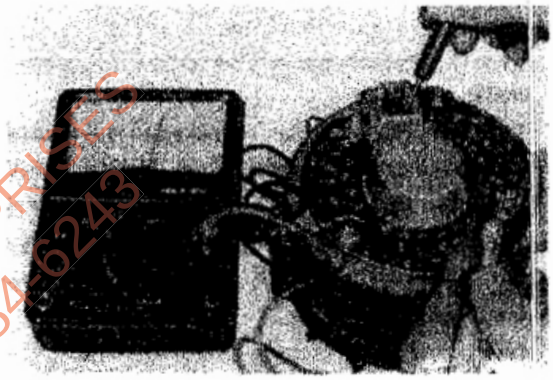


Fig. 10-14

(5)Alternator load performance

With the alternator-rectifier unit in place, run the engine in a speed range of 3,000 to 4,000rpm, with head lamps, 4-way flashers and wiper motor turned on, and check the alternator output voltage and current. Compare the readings against the prescribed values indicated below. An output current which is small means the possibility of the rectifier being defective, any of the stator (armature, coil open-circuited, or an insulation failure resulting in a grounding fault).

Standard output voltage and current	13.8~14.8volts, 20A minimum

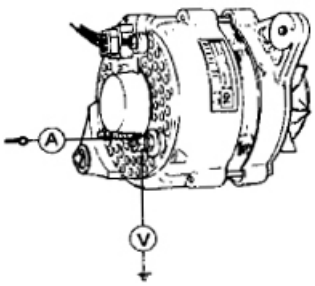


Fig. 10-15

Alternator Regulator

In the two-element regulator, one coil acts as voltage limiter or regulator and the other coil as relay for controlling the charge warning lamp. It should be noted in the circuit diagram that the magnetic pull developed by the voltage coil to move its moving point "P2" is roughly proportional to the alternator output voltage, whereas the magnetic pull developed by the pressure coil of the relay is dependent on the potential level of neutral point "N" of the armature with respect to the ground. A clear understanding of these relations is essential in checking, testing and servicing the regulator unit.

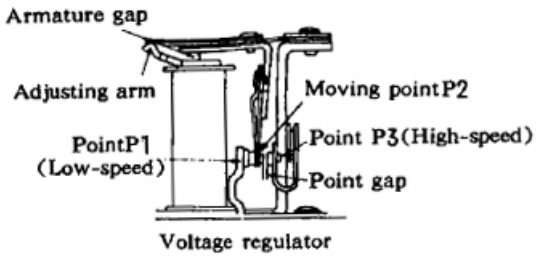


Fig. 10-16

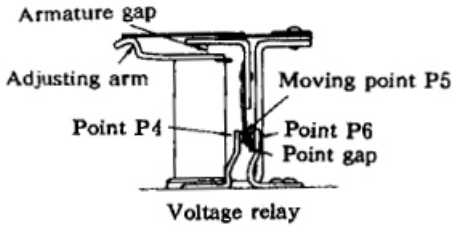


Fig. 10-17

Specifications

Regulated voltage	13. 8～14. 8volts
Voltage-relay cut in voltage	4～5. 8volts

Maintenance services

(1) Voltage-regulator limiting action test

Hook up a voltmeter, inserting it between the alternator "B" terminal and ground, and run the engine within a range 2,000 to 3,000r/min, while reading the voltmeter indication. The voltage read is the charging voltage as limited by the action of the voltage regulator; the reading should be within the prescribed range, which is indicated below. If the charging voltage is found too high or too low, adjust it by bending the adjusting arm of the voltage regulator.

Prescribed range of charging voltage	13. 8～14. 8volts for 2,000～3,000 revolution (rpm)

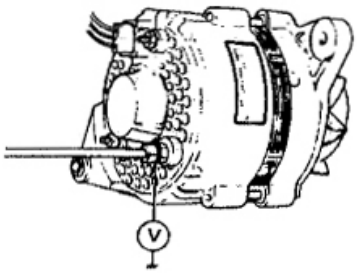


Fig. 10-18

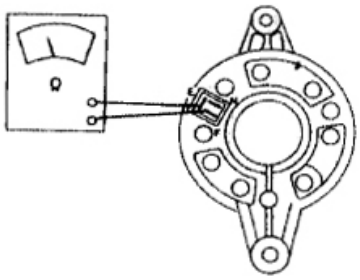


Fig. 10-19

(a) If the charging voltage is noted to oscillate or otherwise be unstable, it is most likely that the contact point faces in the voltage regulator are dirty or roughened. Cleaning and smoothening the faces will remedy this malcondition.

(b) If the charging voltage is too high, the possible causes are as follows;

- Armature gap is too wide on low-speed side or high-speed side in the voltage regulator.
- Contact resistance at high-speed side point is too large.
- The coil of voltage regulator or relay is open-circuited.
- Open circuit in the line to "N" or "B" terminal of the regulator unit. (Refer to Fig. 10-20)
- Contact pressure is too high on low-speed side point.
- Imperfect grounding of the regulator unit.

(2) Continuity test on field coil

Using the ohmmeter, check for continuity between the "E" and "F" terminals of the alternator, as shown. The meter should indicate continuity with a resistance value meeting the following specification;

Standard field circuit resistance	6~9 ohms

(a) If the resistance value noted is too small, it is likely that there is a short-circuit through insulation layers in the coil.

(b) If the resistance value noted is too large, the following possibilities must be considered;

- An open-circuit is developing in the field coil.
- The brushes are not seated properly on the slip rings.
- Brushes or slip rings are burnt.

(3) Checking terminal-to-terminal resistances

Pull off the connector from the regulator unit, remove the cover, and check the resistance between terminals. Refer the resistance readings to the following chart to diagnose the internal condition of the regulator unit;

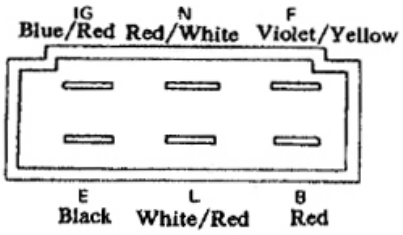


Fig. 10-20

Guide on regulator diagnosis				
Terminal checked	State of vol. relay	State of vol. regulator	Normal resistance value (ohms)	Diagnosis
IG-F		Standstill	Zero	If not zero, point contact is detective on low-speed side.
		Operated	Approx. 11	If infinity is noted, control resistor is open-circuited.
L-E	Standstill		Zero	If not zero, relay contact point is not closing fully.
	Operated		Approx. 100	If zero, relay point faces are fused together. If infinity is noted, voltage coil is open-circuited.
N-E			Approx. 24	If zero, pressure coil is shorted. If infinity, pressure coil is open-circuited.
B-E	Standstill		Infinity	If not infinity, relay point faces are fused together.
	Operated		Approx. 100	If zero, voltage coil is shorted. If infinity, voltage coil is open-circuited or contact action of the point is defective.
B-L	Standstill		Infinity	If not infinity, relay point faces are fused together.
	Operated		Zero	If not zero, contact action of the point is defective.

NOTE:
In the above chart, "standstill" means that the regulator unit is in de-energized state; "operated" means that the armature is pulled in by the coil.

(4) Gap adjustment

(a) Voltage relay

Using a thickness gauge, check the two gaps, point gap and armature gap. Refer the gauge readings to the specification value, left, and adjust the gaps as necessary.

Gap specifications	
Armature gap	Approx. 0.6mm (0.023in.)
Point gap	Approx. 0.4mm (0.015in.)

Fig. 10-21

Fig. 10-22

(b)Voltage regulator

Two gaps are to be checked; point gap, and armature gap. Use a thickness gauge, and compare the readings taken against the following specifications. Adjust the gaps as necessary.

Gap specifications	
Armature gap	Approx. 1. 1mm(0. 043in.)
Point gap	Approx. 0. 5mm(0. 019in.)

Battery

1)Battery specifications

Model	6-QA-36
Rated capacity	36AH, 12Volts
Electrolyte	2. 2litres (5. 3/4. 4 US/Imp. Pt.)
Electrolyte S. G.	1. 280 when fully charged at 25°C(68°F)

2)Care of the battery

The following information is basic in nature and is nothing new; it is merely a reiteration of what every service shop personnel knows about the automotive storage battery. The information is intended to serve as a reminder to the reader, with a hope that he will, in turn, remind each final user of the important basic facts about the battery whenever opportunity permits him to engage in a conversation with the final user in the shop or out of the shop.

(1)The battery is a vary reliable component, but needs periodical attentions.

Keep the battery container clean; prevent rust formation on the terminal posts; keep the electrolyte surface up to level in each cell-uniformly in all cells; and try to keep the battery fully charged at all times.

(2)Preserve the capacity of the battery.

There is a limit to the ability of the battery to hold electricity in store. This limit is called"capacity. "

There are several ways for the battery to lower its capacity:

(a)Loss of electrolyte, or fall in electrolyte level.

When this happens, the battery cannot hold so much electricity as it originally could. Handle the battery with care when you take it down. Barring the loss of electrolyte by careless spilling or other-

wise, the electrolyte level goes down gradually in the battery at work because the water content of it evaporates. Periodically refill distilled water to each cell, as necessary, so that the electrolyte is always up to the specified level. Never allow its surface to fall so much as to expose the cell plates.

(b) Overcharging the battery in place or off the machine.

In recharging the battery off the machine, caution must be exercised so as not to overcharge it. Overcharging gives rise to several complexities. For one thing, it heats up the battery to melt the pitch to result in a destroyed battery. Overcharging could occur in a battery in place if the voltage regulator is maladjusted to allow the alternator (or the dynamo in other machines) to develop too high an output voltage. For another thing, "gassing" occurs in a battery being overcharged to result in a loss of water content. One of the most serious consequences of overcharging is the swelling of positve-plate grids, causing the grids to crumble and the plates to buckle.

(c) Undercharging the battery in place.

Regulator malfunctioning is usually the cause of the battery remaining in a state of charge far below its capacity. This condition is very undesirable in freezing weather, for the electrolyte in such a battery can easily freeze up to result in a destroyed battery. Moreover, an undercharged battery is an easy prey to a greater evil-sulfation.

(d) Sulfation.

Let us recall the electrochemical reactions that take place in the battery during charging and discharging. As the battery gives out its energy (discharging), the active materials in its cell plates are converted into lead sulfate. During recharging, this lead sulfate is reconverted into active material. If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. "Sulfation" means the result as well as the process of that reaction. Such a battery can be revived by very slow charging and may be restored to usable condition but it is a damaged battery and its capacity is lower than before.

(3) Keep the battery cable connections clean.

The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current. The inability of the starter motor to crank the engine is often due to the rust formation in the battery cable connection. Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.

(4) Be always in the know as to the state of charge of the battery.

The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an inexpensive instrument for measuring the specific gravity (S. G.) of the battery electrolyte. Why measure the S. G. ? Because the S. G. of the electrolyte is indicative of the state of charge.

The direct method of checking the battery for state of charge is to carry out a high-discharge test, which involves a special low-reading voltmeter, an expensive instrument used generally in the service shops but no recommendable to the user of the machine.

At 20°C of battery temperature (electrolyte temperature):

The battery is in FULLY CHARGED STATE if the electrolyte S. G. is 1. 280.

The battery is in HALF CHARGED STATE if the S. G. is 1. 220.

The battdery is in NEARLY DISCHARGED STATE if the S. G. is 1. 150and is in danger of

freezing.

What if the battery temperatures not 20°C(68°F)? Since the S. G. varies with temperature, you have to correct your S. G. reading (taken with your hydrometer) to the value at 20°C, and apply the corrected S. G. value to the three-point guide stated above. This manner of correction needs a chart showing the relation between S. G. and temperature. There is a simpler way, refer to the graph given below, which tells you the state of charge for a range of S. G. value and a range of temperature.

How to use the temperature-corrected state-of-charge graph.

Suppose your S. G. reading is 1. 28 and the battery temperature is -5°C(23°F). Locate the intersection of the -5°C line and the 1. 28 S. G. line. The intersection is "A". It is in the zone for CHARGED STATE. How much is the battery charged? To find out the answer, draw a line parallel to the zone demarcation line, extending it to the right, and see where this line crosses the percentage scale. In the present example, the line crosses at, say, 85% point. The battery is 85% fully charged.

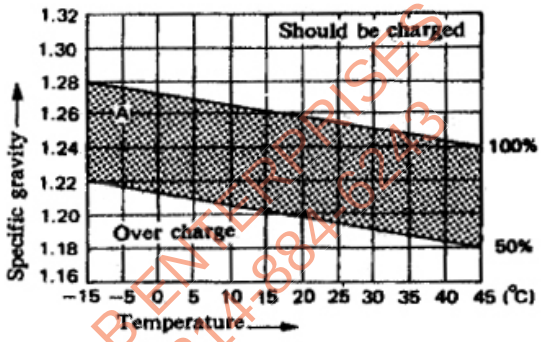


Fig. 10-24

SECTION 7A

MANUAL TRANSMISSION

CONTENTS

GENERAL DESCRIPTION

CONSTRUCTION AND SERVICING

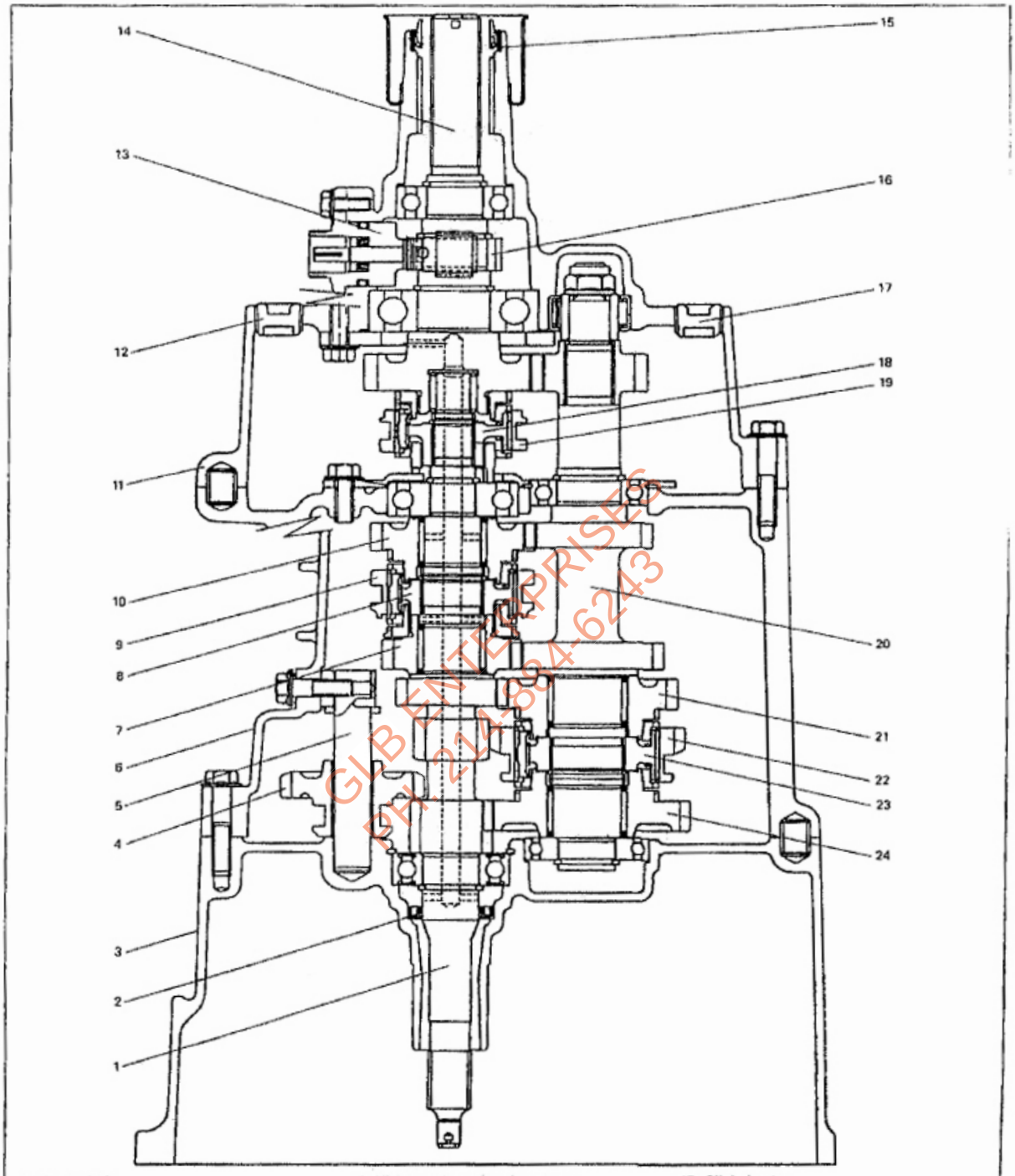
The transmission provides five forward speeds and one reverse speed by means of three synchronizers and four shafts – input shaft, main shaft, countershaft and reverse gear shaft. All forward gears are in constant mesh, and reverse uses a sliding idler gear arrangement.

The low speed synchronizer is mounted on counter shaft and engaged with counter shaft first gear or second gear, while the high speed synchronizer is done on input shaft and engaged with input shaft third gear or fourth gear.

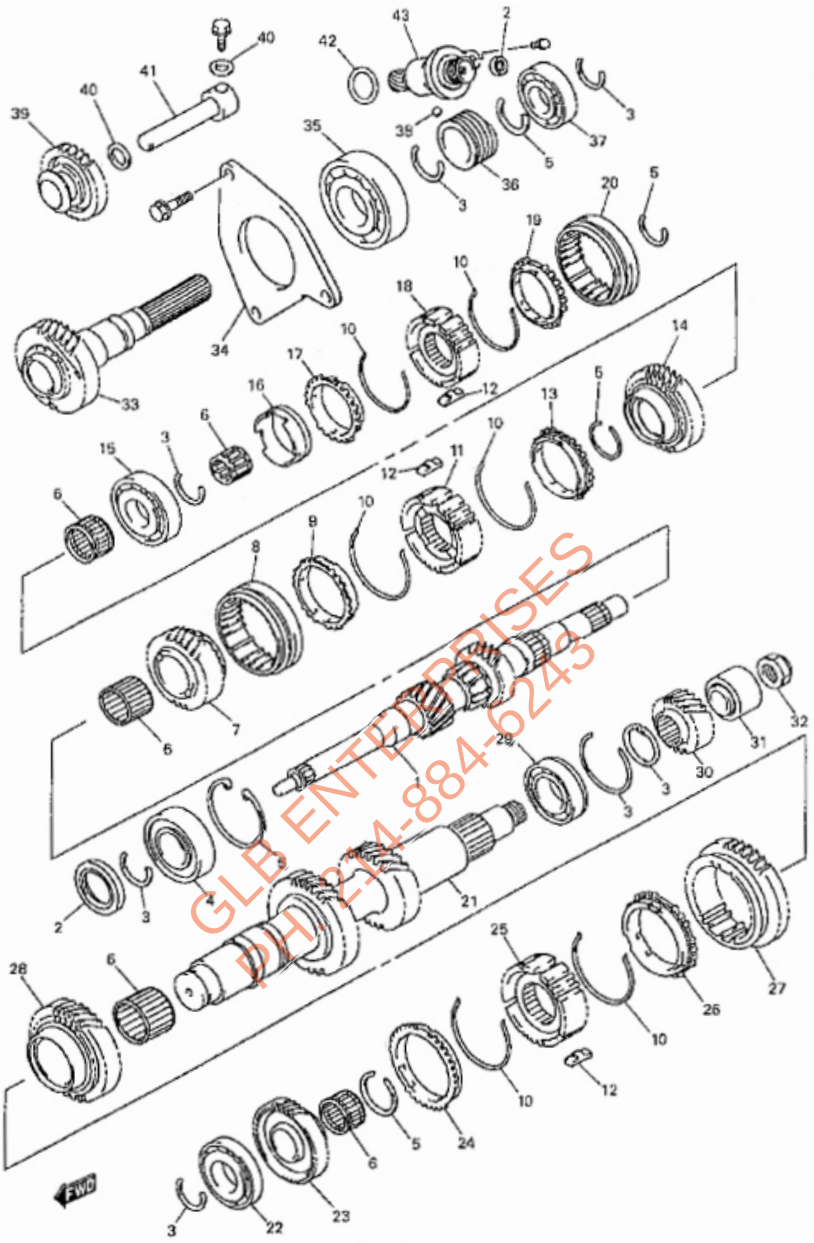
The fifth speed synchronizer on input shaft is engaged with fifth gear mounted on the main shaft.

The gear shift & select shaft is located at the upper of the transmission case and has a cam which prevents direct gear shift from the 5th speed gear to the reverse gear.

For servicing, it is necessary to use genuine sealant or its equivalent on mating surfaces of transmission case which is made of aluminum. The case fastening bolts must be tightened to specified torque by means of torque wrench. It is also important that all parts are thoroughly cleaned with cleaning fluid and air dried before reassembling.



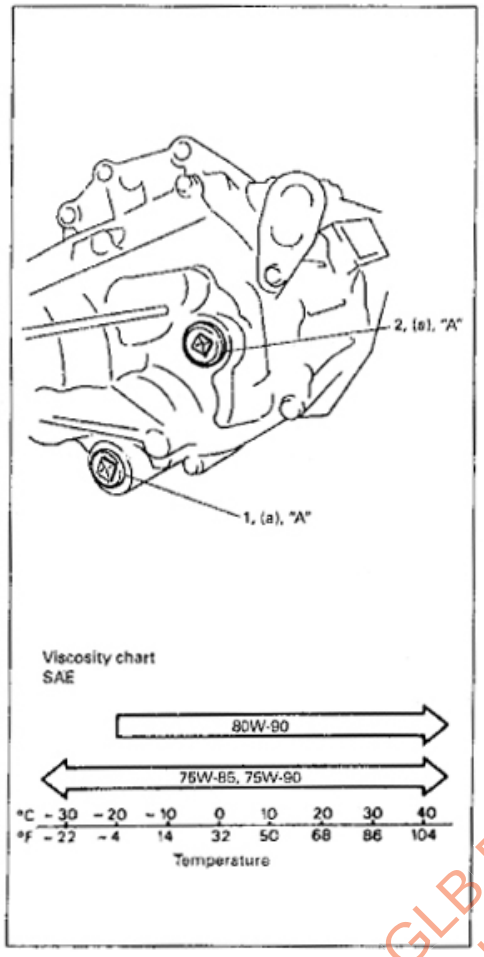
1. Input shaft
2. Input shaft oil seal
3. Front case
4. Reverse idler gear
5. Reverse gear shaft
6. Rear case
7. Input shaft 3rd gear
8. High speed synchronizer hub
9. High speed synchronizer sleeve
10. Input shaft 4th gear
11. Extension case
12. Oil filler plug
13. Speedometer driven gear
14. Main shaft
15. Extension case oil seal
16. Speedometer drive gear
17. Oil drain plug
18. 5th speed synchronizer hub
19. 5th speed synchronizer sleeve
20. Countershaft
21. Countershaft 2nd gear
22. Low speed synchronizer sleeve
23. Low speed synchronizer hub
24. Countershaft 1st gear



1. Input shaft
2. Oil seal
3. Snap ring
4. Input shaft front bearing
5. Circlip
6. Needle bearing
7. Input shaft 3rd gear
8. High speed sleeve
9. Synchronizer ring (3rd)
10. Synchronizer key spring
11. High speed synchronizer hub
12. Synchronizer key
13. Synchronizer ring
14. Input shaft 4th gear
15. Input shaft rear bearing
16. Reverse brake cone
17. Synchronizer ring (Reverse)
18. 5th speed synchronizer hub
19. Synchronizer ring (5th)
20. 5th/REV. sleeve
21. Countershaft
22. Countershaft front bearing
23. Countershaft 1st gear
24. Synchronizer ring (1st)
25. Low speed synchronizer hub
26. Synchronizer hub (2nd)
27. Low speed sleeve
28. Countershaft 2nd gear
29. Countershaft center bearing
30. Countershaft drive gear
31. Inner spacer
32. Countershaft nut
33. Main shaft
34. Bearing plate
35. Main shaft front bearing
36. Speedometer drive gear
37. Main shaft rear bearing
38. Ball
39. Reverse idler gear
40. Washer
41. Reverse gear shaft
42. O-ring
43. Speedometer driven gear assembly

DIAGNOSIS

Condition	Possible Cause	Correction
Gear slipping out of mesh	• Worn shift fork shaft	Replace
	• Worn shift fork or synchronizer sleeve	Replace
	• Weak or damaged locating spring	Replace
	• Worn bearings on input shaft or mainshaft	Replace
	• Worn chamfered tooth on sleeve and gear	Replace sleeve and gear
	• Missing or disengagement of circlip(s)	Install
Gears refusing to disengage	• Weakened or broken synchronizer spring	Replace
	• Distorted shift shaft or shift fork	Replace
Hard shifting	• Improper clutch pedal free travel	Adjust
	• Distorted or broken clutch disc	Replace
	• Damaged clutch pressure plate	Replace clutch cover
	• Worn synchronizer ring	Replace
	• Worn chamfered tooth on sleeve or gear	Replace sleeve and gear
	• Distorted shift shaft	Replace
Noise	• Inadequate or insufficient lubricant	Replenish
	• Damaged or worn bearing(s)	Replace
	• Damaged or worn gear(s)	Replace
	• Damaged or worn synchronizer ring	Replace
	• Damaged or worn chamfered tooth on sleeve or gear	Replace



ON-VEHICLE SERVICE

OIL CHANGE

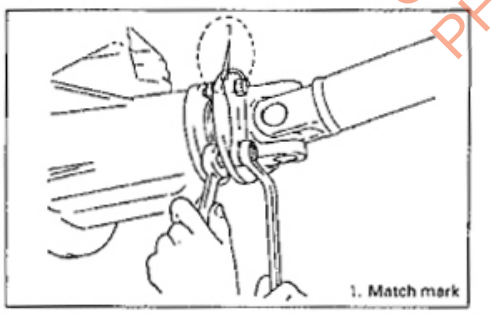
1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
2) With vehicle lifted up, check oil level and leakage. If leakage exists, correct it.
3) Drain old oil and apply sealant to thread of drain plug and torque it as specified below.
4) Fill new specified oil by specified amount (up to level hole).
5) Torque level/filler plug as specified below.

"A": Sealant 99000-31110

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

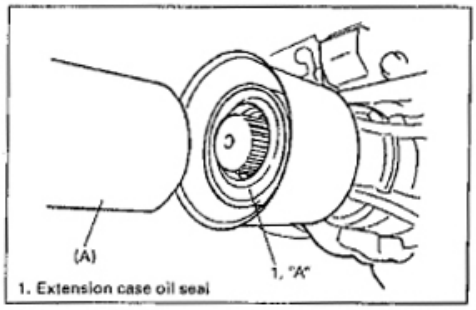
NOTE:
- **It is recommended to use API GL-4 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

Oil specification: API GL-4
For SAE classification, refer to viscosity chart at the left.
Oil capacity: 1.2 liters (2.5/2.1 US/Imp. pt)



EXTENSION CASE OIL SEAL REPLACEMENT

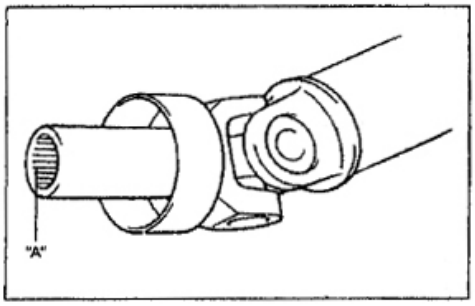
1) Lift up vehicle horizontally.
2) Give match marks on joint flange and propeller shaft as shown in figure.
3) Remove 4 blots from rear propeller shaft flange and remove propeller shaft.
4) Using screwdriver, remove oil seal.



5) Using special tool and plastic hammer, press-fit new oil seal up to case surface. Be sure to apply grease to oil seal lip.

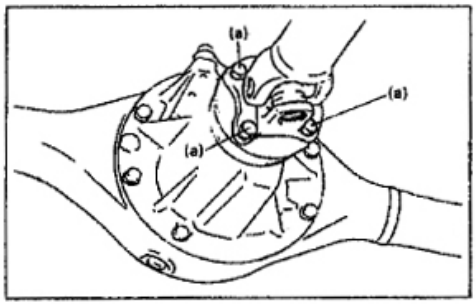
"A" : Grease 99000-25010

Special Tool
(A) : 09940-51710



6) Clean and inspect sliding portion of propeller shaft front end (where oil seal contacts) before installation and if even small dent or scratch exists, correct and clean it again. Then apply grease inside splines of propeller shaft.

"A" : Grease 99000-25010



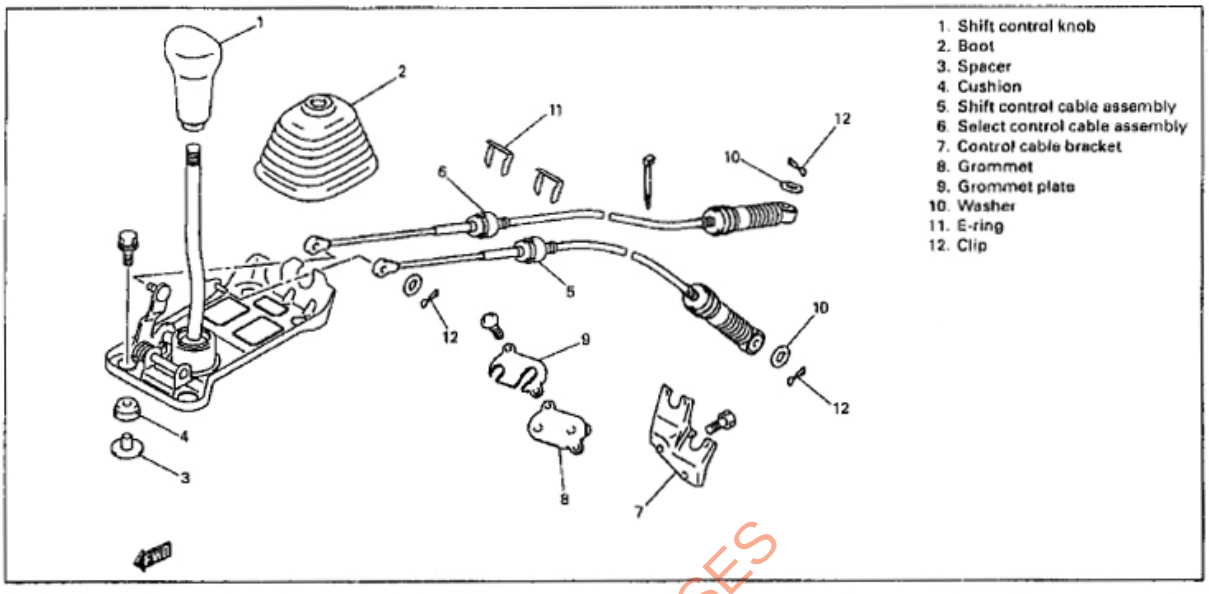
7) Install propeller shaft and torque universal joint flange bolts to specification.

CAUTION:
Be sure to use only specified bolts, nuts and lock washers for universal joint flange.

Tightening Torque :
(a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)

8) Check oil level and add new specified oil as necessary (roughly up to level hole).

GEAR SHIFT CONTROL LEVER AND CABLE



REMOVAL

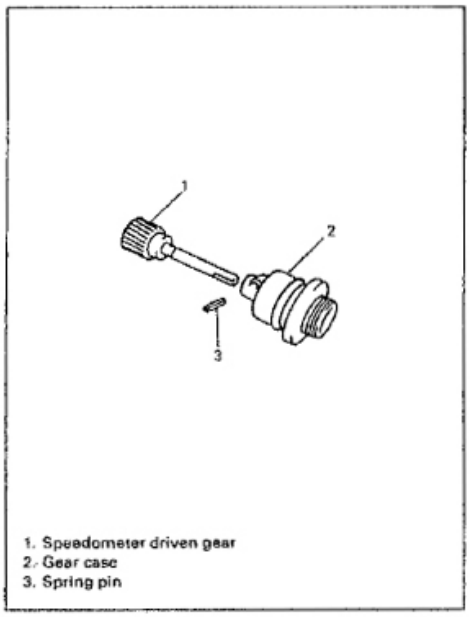
1) Remove T/M control cable end clips and washers.
2) Loosen 2 bolts and remove control cable bracket from T/M rear case.
3) Remove console box and then gear control cable grommet plate.
4) Disconnect gear shift & select control cables from gear shift control lever assembly.
5) Loosen 4 bolts and take out shift control lever assembly.

INSTALLATION

1) Apply grease to turning or sliding portions.
2) If knob has been removed from lever, apply thread lock cement and then install knob to control lever. Make sure that knob is aligned with lever.
3) Install control lever assembly and related parts as they were.

NOTE:

- **Make sure that boots are installed correctly.**
- **Check control lever for smooth movement after assembly.**



1. Speedometer driven gear
2. Gear case
3. Spring pin

SPEEDOMETER DRIVEN GEAR

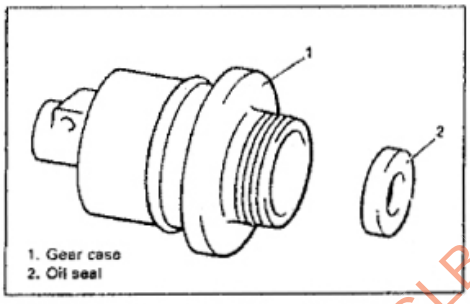
REMOVAL

1) Lift up vehicle horizontally or rear up.
2) Disconnect speedometer cable at transmission.
3) Remove bolt and take off gear case from transmission.

NOTE:
Transmission oil, although small amount, may be released then. Place oil container under speedometer driven gear case hole.

4) Drive out spring pin and remove speedometer driver gear.

NOTE:
- **Use pin remover of 2.8 – 3.0 mm (0.11 in.) diameter for spring pin removal.**
- **Do not support or hit driven gear while removing spring pin.**



1. Gear case
2. Oil seal

5) Remove oil seal from case.

NOTE:
Use small L-type drive handle to remove oil seal.

INSTALLATION

1) Make sure that O-ring and case have not been damaged and apply grease to O-ring.
2) Apply grease to driven gear as shown in figure.
3) Apply grease to lip portion of new oil seal and install it until bottom, directing lip side toward inside. Special tool may be used for installation.

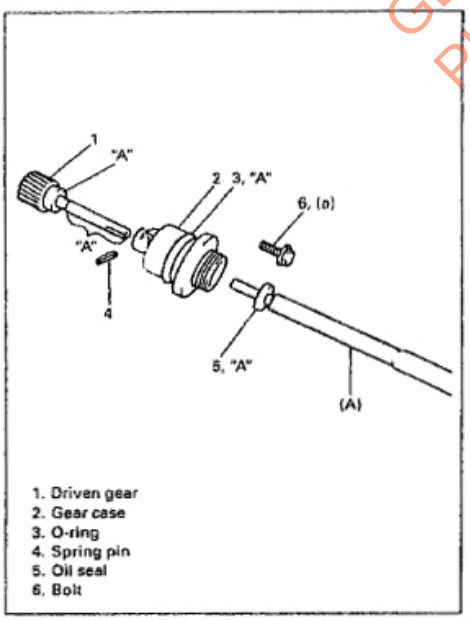
"A" : Grease 99000-25010

Special Tool
(A) : 09916-46010

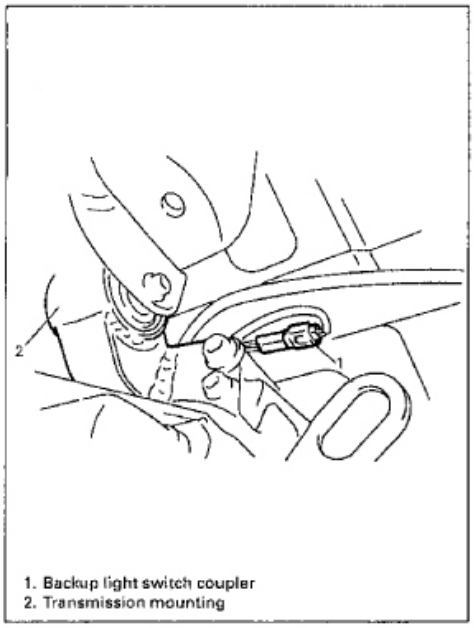
4) Inspect speedometer driven gear for abnormal wear of gear teeth or bend of shaft portion and replace it if necessary.
5) Insert driven gear to case and fix it with spring pin, then make sure its smooth rotation.
6) Install case assembly to transmission and connect cable as it was.

Tightening Torque
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

7) Make sure that oil level is in specification.



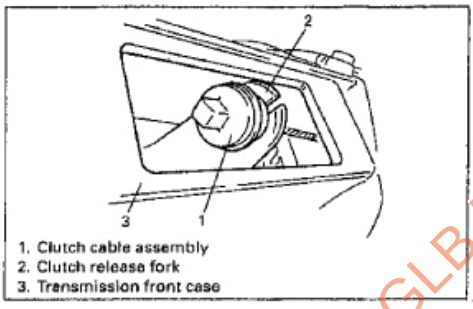
1. Driven gear
2. Gear case
3. O-ring
4. Spring pin
5. Oil seal
6. Bolt



1. Backup light switch coupler
2. Transmission mounting

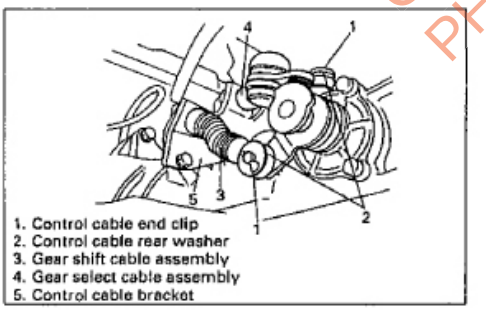
DISMOUNTING

1) Disconnect negative (–) and positive (+) cords from battery terminals and hoist car.
2) Disconnect back up light switch lead wire at coupler.
3) Disconnect Black/yellow lead wire and positive (+) cord from starting motor.
4) Remove starting motor from transmission case and disconnect battery negative (–) cord from transmission case.
5) Free back up light switch lead wire from clamps.
6) Disconnect speedometer cable from transmission case.
7) Remove drain plug to drain oil in transmission.



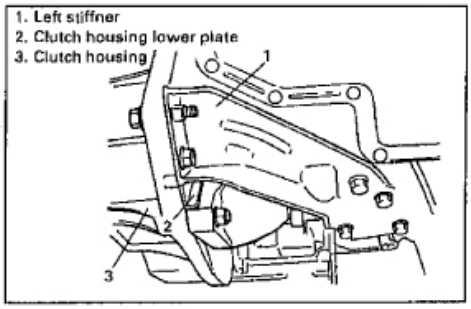
1. Clutch cable assembly
2. Clutch release fork
3. Transmission front case

8) Remove transmission front case cap and disconnect clutch cable from clutch release fork.



1. Control cable end clip
2. Control cable rear washer
3. Gear shift cable assembly
4. Gear select cable assembly
5. Control cable bracket

9) Remove control cable end clips and washers, and then disconnect gear shift cable and select cable from each lever.
10) Remove control cable bracket.

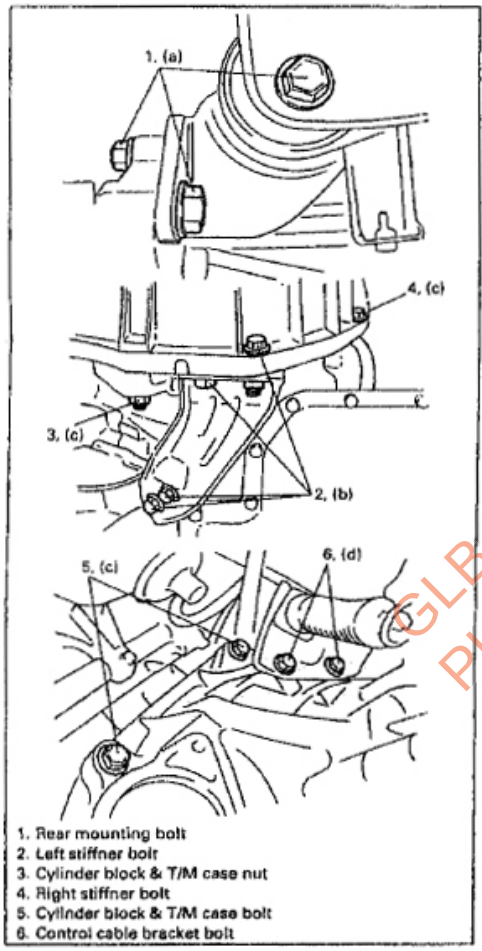


11) Remove propeller shaft.
12) Remove left stiffner, and then remove clutch housing lower plate from transmission case.

13) Remove nuts fastening engine cylinder block and transmission case.

NOTE:
Before starting to remove transmission, check arouno once again to be sure that there is no connection left undone.

14) Remove transmission rear mounting bolt & nut from chassis.
15) Take down transmission.



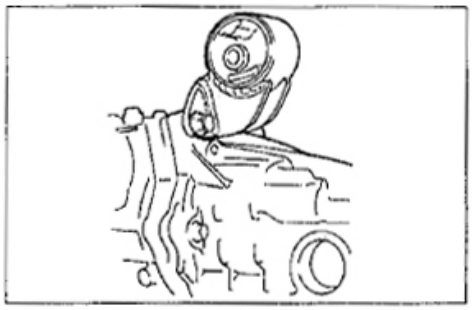
1. Rear mounting bolt
2. Left stiffner bolt
3. Cylinder block & T/M case nut
4. Right stiffner bolt
5. Cylinder block & T/M case bolt
6. Control cable bracket bolt

REMOUNTING

For remounting, reverse dismounting procedure.
Use specified torques as given below.

Tightening Torque
(a): 50 N·m (5.0kg-m, 36.0 lb-ft)
(b): 55 N·m (5.5kg-m, 40.0 lb-ft)
(c): 61 N·m (6.1kg-m, 44.0 lb-ft)
(d): 23 N·m (2.3kg-m, 17.0 lb-ft)

NOTE:
- **To facilitate remounting, install rear mounting to transmission after inserting input shaft into clutch disc.**
- **For tightening torque of starting motor bolts, refer to section 6G1.**
- **Refill specified amount of gear oil as previously outlined.**
- **After connecting clutch cable, be sure to adjust its play properly (refer to SECTION 7C).**

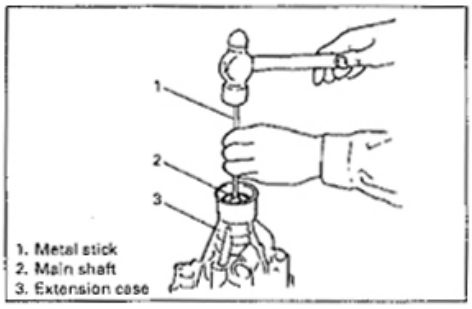


UNIT REPAIR

UNIT DISASSEMBLY

MAIN SHAFT

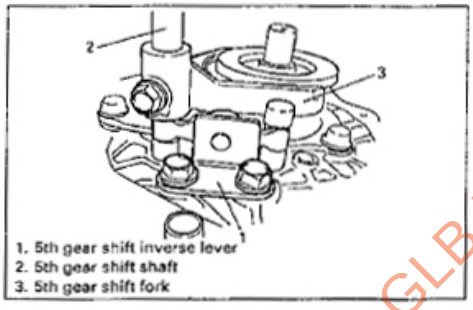
1) Remove 7 bolts and transmission mounting, and then take off extension case.



1. Metal stick
2. Main shaft
3. Extension case

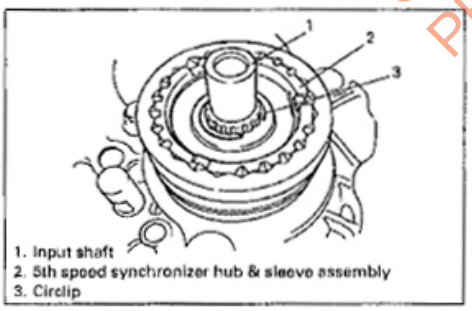
2) Remove main shaft front bearing plate and then drive out main shaft assembly by using metal stick and hammer.

CAUTION:
Be careful not to damage oil seal.



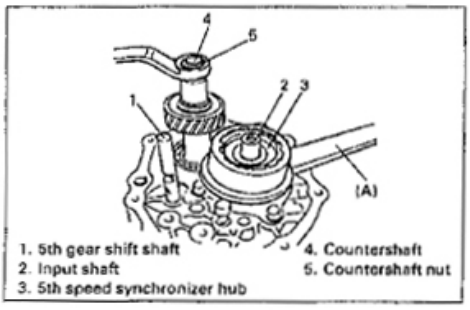
1. 5th gear shift inverse lever
2. 5th gear shift shaft
3. 5th gear shift fork

3) Remove 5th gear shift inverse lever.
4) Remove bolt and then take out 5th gear shift shaft and shift fork.



1. Input shaft
2. 5th speed synchronizer hub & sleeve assembly
3. Circlip

5) Remove circlip and then take out 5th speed synchronizer sleeve & hub assembly, reverse shift brake ring and taper cone.
6) Disassemble sleeve & hub assembly.

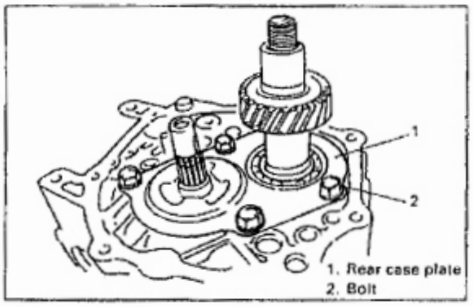


1. 5th gear shift shaft
2. Input shaft
3. 5th speed synchronizer hub
4. Countershaft
5. Countershaft nut

7) Push low speed gear shift shaft by using 5th gear shift shaft so that countershaft is engaged with input shaft.
8) Unfasten caulking of countershaft nut, install 5th speed synchronizer hub together with special tool, and then remove countershaft nut.

Special Tool
(A) : 09927-25411

9) Remove 5th gear shift shaft, synchronizer hub and special tool.

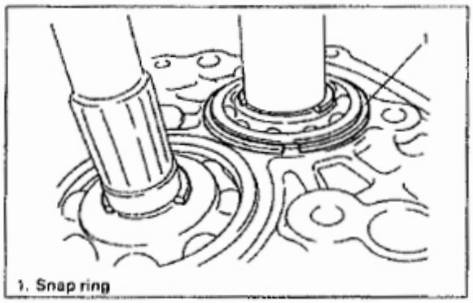


1. Rear case plate
2. Bolt

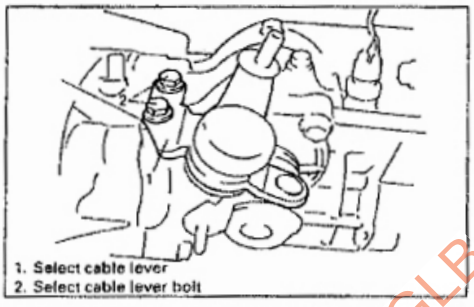
10) Remove 5 bolts and then take off rear case plate.

GEAR SHIFTER, INPUT SHAFT AND COUNTER-SHAFT

1) Remove countershaft center bearing snap ring.

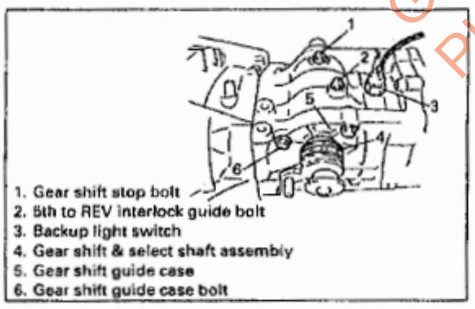


1. Snap ring



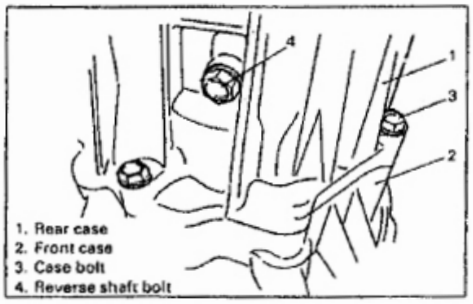
1. Select cable lever
2. Select cable lever bolt

2) Unfasten 2 bolts and then take out select cable lever.



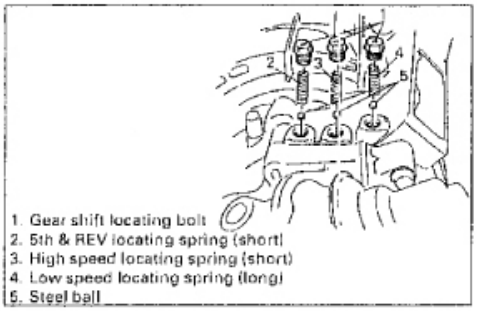
1. Gear shift stop bolt
2. 5th to REV interlock guide bolt
3. Backup light switch
4. Gear shift & select shaft assembly
5. Gear shift guide case
6. Gear shift guide case bolt

3) Remove gear shift stop bolt and 5th to reverse interlock guide bolt.
4) Remove back up light switch.
5) Remove 3 bolts from gear shift guide case and then pull out gear shift & select shaft assembly.

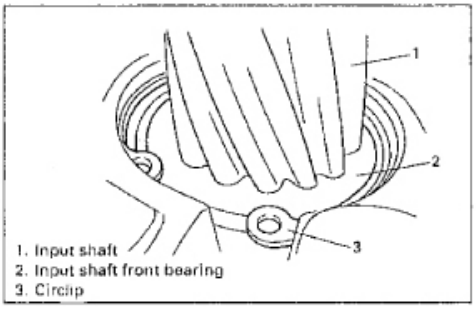


1. Rear case
2. Front case
3. Case bolt
4. Reverse shaft bolt

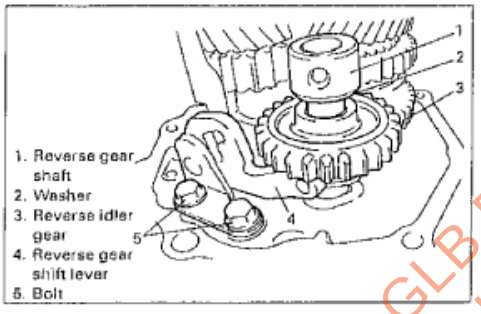
6) Remove reverse shaft bolt with washer.
7) Remove 5 case bolts from outside and another 3 from front case side.
8) Separate rear case from front case and remove it.



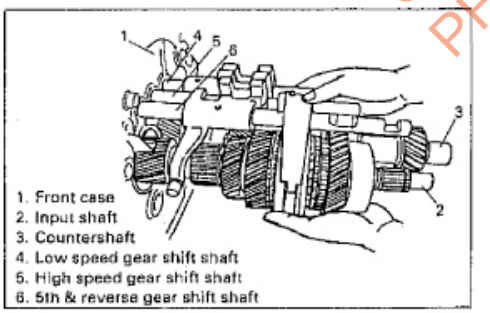
9) Remove gear shift locating bolts and take out low locating spring, high & 5th locating springs and 3 balls.



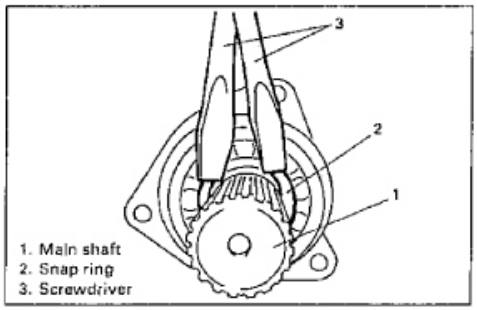
10) Remove input shaft front bearing circlip.



11) Remove 2 bolts and reverse gear shift lever.
12) Pull out reverse gear shaft with washer, then take off reverse idler gear.



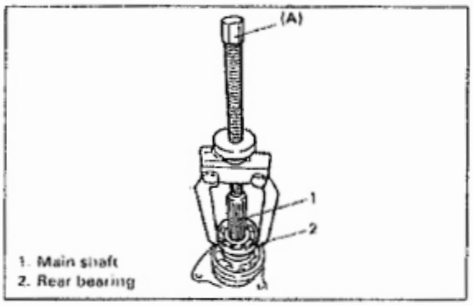
13) Tapping input shaft end with plastic hammer, push it out as assembly from case a little, then take out input shaft assembly, counter shaft assembly, high speed gear shift shaft, low speed gear shift shaft and 5th & reverse gear shift shaft all at once.
14) Remove input shaft oil seal from front case as necessary.



MAIN SHAFT ASSEMBLY

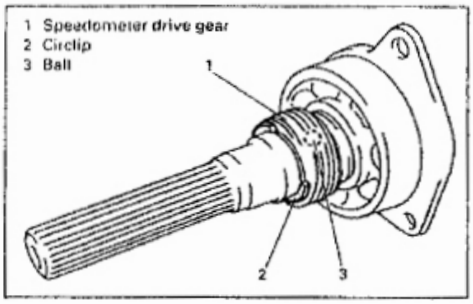
DISASSEMBLY

1) Remove snap ring as shown in figure.

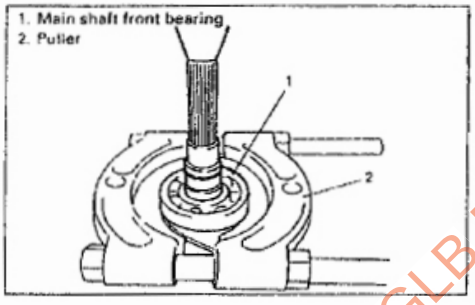


2) Drive out rear bearing by using special tool.

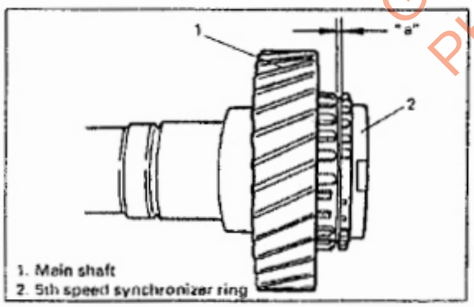
Special Tool
(A) : 09913-65135



3) Remove circlip, and then take out speedometer drive gear and ball.



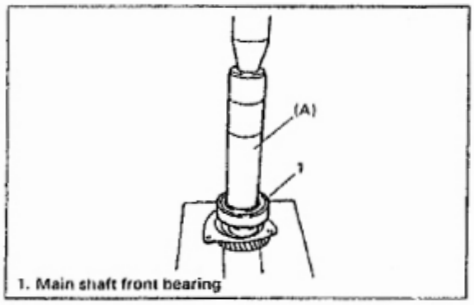
4) Remove snap ring, and then pull off front bearing by using puller and press.



INSPECTION AND REASSEMBLY

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2) If synchronizer parts need to be repaired, check clearance "a" between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

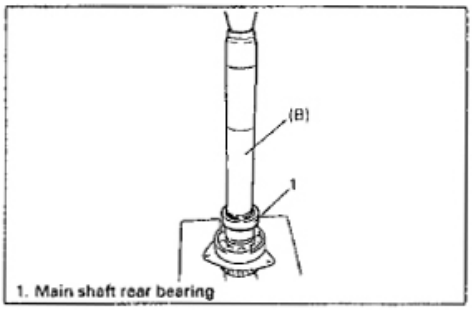
Clearance "a" : Standard 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit 0.5 mm (0.019 in.)



3) Apply gear oil to front bearing, press-fit it by using special tool and press, and then install snap ring.

Special Tool
(A) : 09940-51710

4) Install ball, speedometer drive gear and circlip.



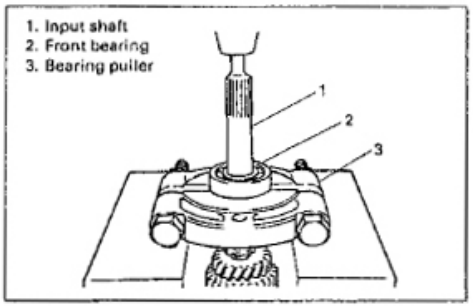
5) Apply gear oil to rear bearing, press-fit it by using special tool and press, and then install snap ring.

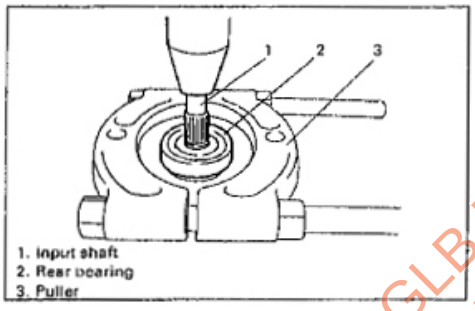
Special Tool
(B) : 09925-18010

INPUT SHAFT ASSEMBLY

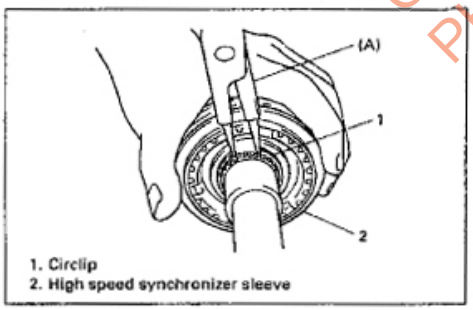
DISASSEMBLY

1) Remove snap ring and then remove input shaft front bearing by using bearing puller and press.





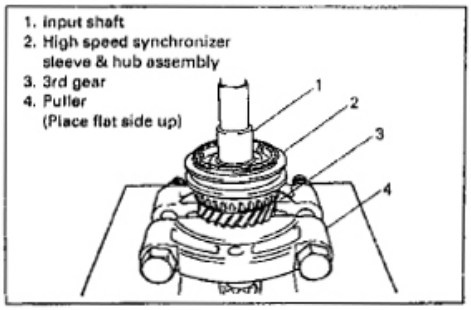
2) Remove snap ring and pull off rear bearing by using puller and press.



3) Take out 4th gear, needle bearing and high speed synchronizer ring.
4) Using special tool, remove circlip.

NOTE:
For smooth removal of circlip, it is recommended to correct tool tips to be flat.

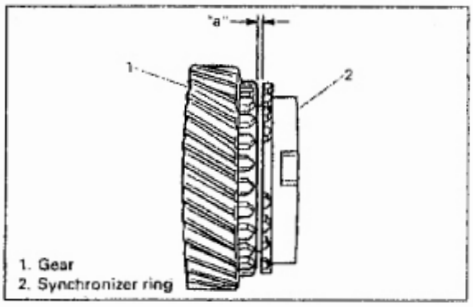
Special Tool
(A) : 09900-06107



5) Drive out high speed synchronizer sleeve & hub assembly together with 3rd gear by using puller and press.

CAUTION:
Make sure to use flat side of puller to avoid causing damage to 3rd gear tooth.

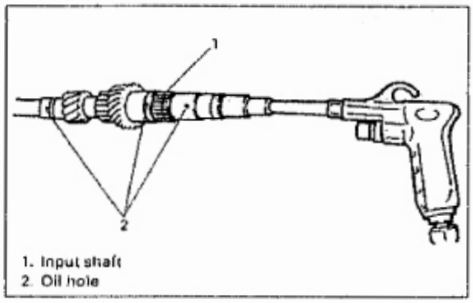
6) Take out 3rd gear needle bearing from shaft.
7) Disassemble synchronizer sleeve & hub assembly.



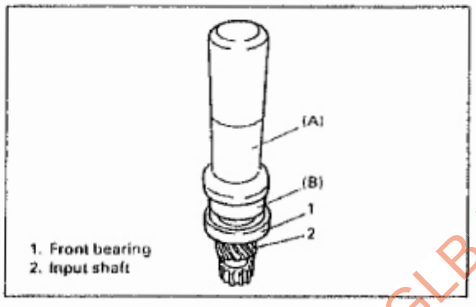
INSPECTION AND REASSEMBLY

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2) If synchronizer parts need to be repaired, check clearance "a" between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

Clearance "a": Standard 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit 0.5 mm (0.019 in.)

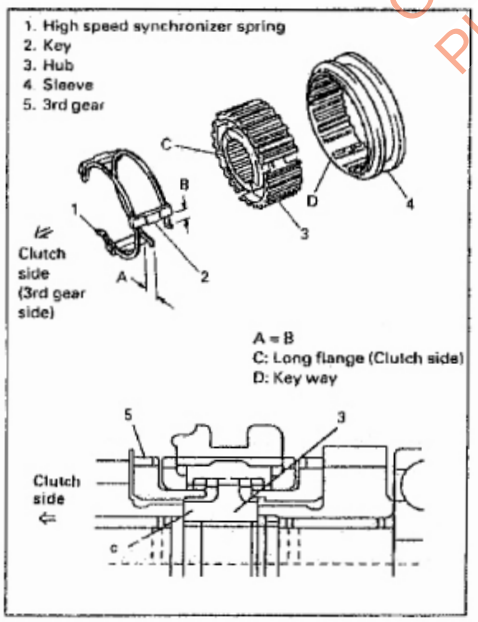


3) To ensure lubrication, air blow oil holes and make sure that they are free from any obstruction.



4) Apply gear oil to front bearing, press-fit it by using special tool and press, and then install snap ring.

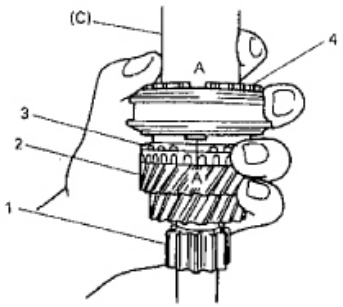
Special Tool
(A) : 09951-16080
(B) : 09940-54950



5) Fit high speed synchronizer sleeve to hub, insert 3 keys in it and then set springs as illustrated left.

NOTE:

- **No specific direction is assigned to each key but it is assigned as assembly.**
- **Size of high speed synchronizer sleeve, hub, keys and springs is between those of low speed and 5th speed ones.**



1. Input shaft
2. 3rd gear
3. Synchronizer ring
4. Sleeve & hub assembly

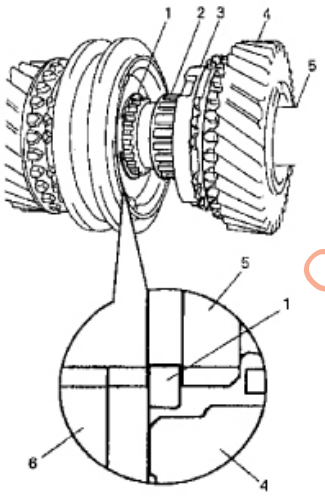
A. Key way

6) Install 3rd gear needle bearing and apply gear oil to it.
7) Install 3rd gear and synchronizer ring after applying gear oil to them.
8) Drive in high speed sleeve & hub assembly by using special tool and hammer.

NOTE:

- **High speed sleeve & hub assembly has specific installing direction. Refer to figure at step 5) in this item.**
- **While press-fitting sleeve & hub, make sure that synchronizer ring key slots are aligned with keys in sleeve & hub assembly.**
- **Check free rotation of 3rd gear after press-fitting sleeve & hub assembly.**
- **Synchronizer rings for 3rd and 4th are identical.**

Special Tool
(C): 09913-84510

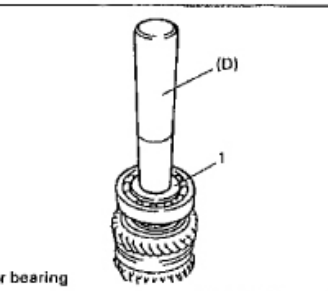


1. Circlip
2. Needle bearing
3. Synchronizer ring
4. 4th gear
5. Input shaft
6. Synchronizer hub

9) Install circlip in proper direction as shown in figure. Apply gear oil to needle bearing and install it.

CAUTION:
Confirm that circlip is installed in groove securely.

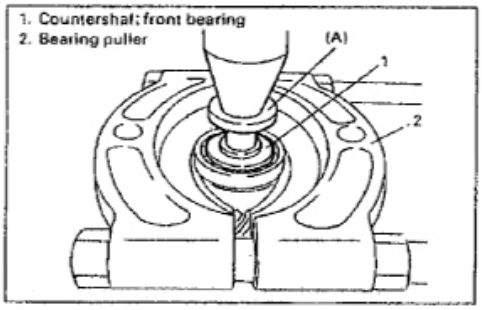
10) Install synchronizer ring. Apply gear oil to sliding portion of 4th gear and install it.



1. Rear bearing

11) Press-fit rear bearing by using special tool and hammer, and then install snap ring.

Special Tool
(D): 09925-98221



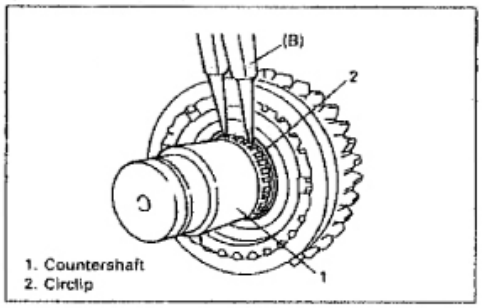
COUNTERSHAFT ASSEMBLY

DISASSEMBLY

1) Remove snap ring and then drive out front bearing by using special tool, puller and press.

Special Tool
(A): 09913-85230

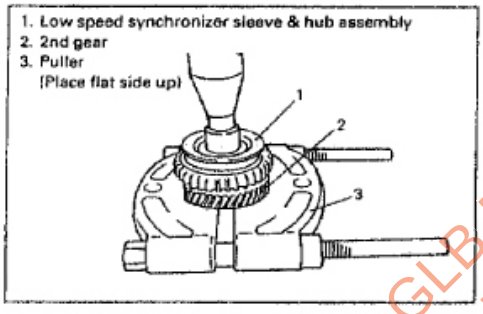
2) Take out 1st gear, 1st gear needle bearing and synchronizer ring.



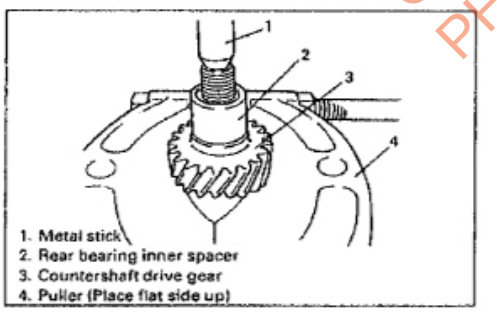
3) Using special tool, remove circlip.

NOTE:
Correct tool tips to be flat to facilitate removal of circlip.

Special Tool
(B): 09900-06107

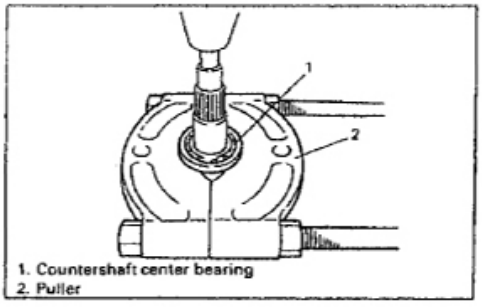


4) Apply puller to 2nd gear and pull off low speed synchronizer sleeve & hub assembly with gear by using press.
5) Disassemble synchronizer sleeve & hub assembly.
6) Take out needle bearing from shaft.

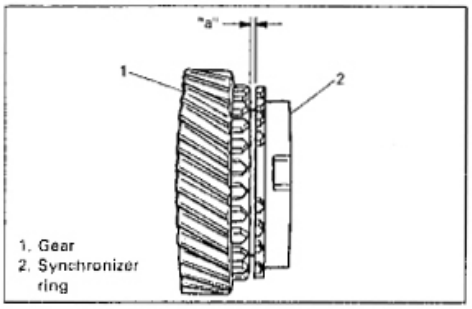


7) Apply puller to drive gear and pull off rear bearing inner spacer with gear by using puller, metal stick and press.

CAUTION:
Make sure to use flat side of puller so as not to damage drive gear tooth.



8) Remove snap ring and then drive out center bearing by using puller and press.

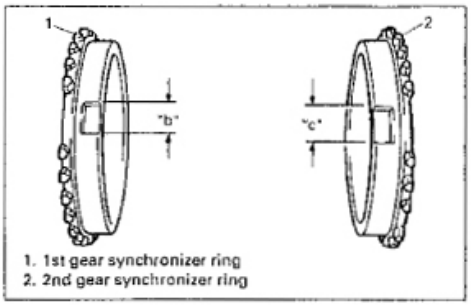


1. Gear
2. Synchronizer ring

INSPECTION AND REASSEMBLY

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2) If synchronizer parts need to be repaired, check clearance "a" between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

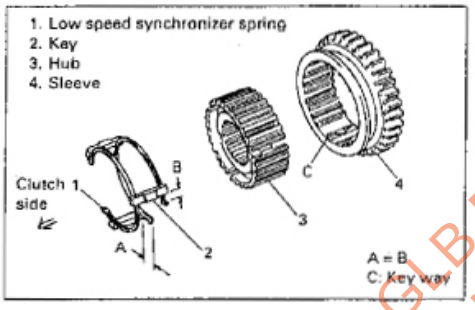
Clearance "a": Standard 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit 0.5 mm (0.019 in.)



1. 1st gear synchronizer ring
2. 2nd gear synchronizer ring

3) Install 2nd gear needle bearing and apply gear oil to it.
4) Apply gear oil to sliding portion of 2nd gear, and then install 2nd gear and 2nd gear synchronizer ring.

NOTE:
Key slot width of 1st synchronizer ring is smaller than that of 2nd synchronizer ring.
Distinguish the difference properly.
Width "b": 8.2 mm (0.32 in.)
"c": 8.8 mm (0.35 in.)



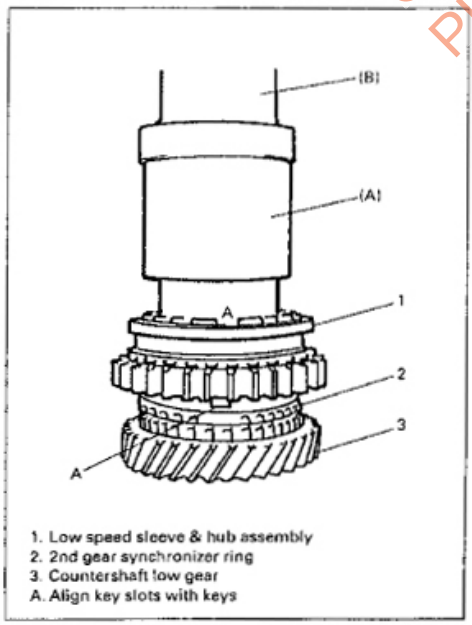
5) Fit low speed synchronizer sleeve to hub, insert 3 keys in it and then set springs as illustrated left.

NOTE:
- **No specific direction is assigned to low speed synchronizer hub or each key but it is assigned as assembly.**
- **Size of low speed synchronizer keys and springs are the largest compared with those of high speed and 5th speed ones.**

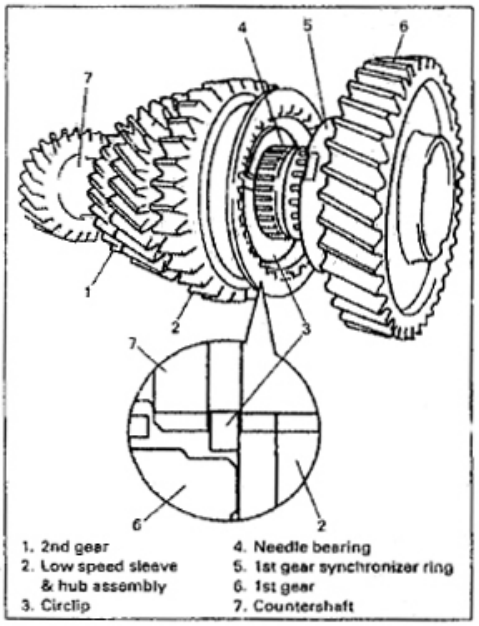
6) Drive in low speed sleeve & hub assembly by using special tool and hammer.

NOTE:
- **Make sure that synchronizer ring key slots are aligned with keys while press-fitting sleeve & hub assembly.**
- **Check free rotation of 1st and 2nd gears after press-fitting sleeve & hub assembly.**

Special Tool
(A): 09940-53111
(B): 09913-85210



1. Low speed sleeve & hub assembly
2. 2nd gear synchronizer ring
3. Countershaft low gear
A. Align key slots with keys

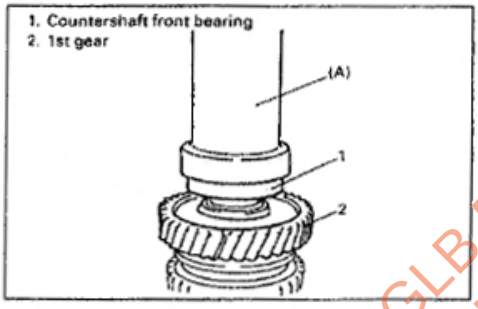


1. 2nd gear
2. Low speed sleeve & hub assembly
3. Circlip
4. Needle bearing
5. 1st gear synchronizer ring
6. 1st gear
7. Countershaft

7) Install circlip in proper direction as shown in figure.

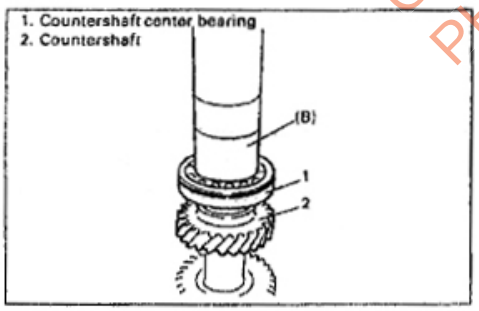
CAUTION:
Confirm that circlip is installed in groove securely.

8) Install needle bearing and apply gear oil to bearing. Then install 1st gear synchronizer ring.
Apply gear oil to sliding portion of 1st gear and install it.



9) Apply gear oil to front bearing, install it by using special tool and press and then install snap ring.

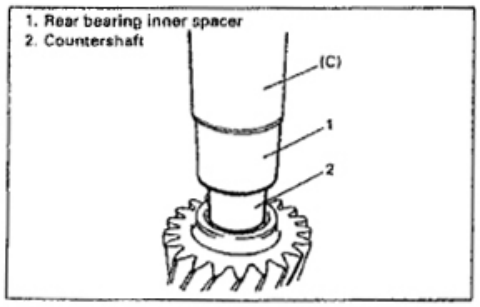
Special Tool
(A): 09913-85210



10) Apply gear oil to center bearing, install it by using special tool and hammer and then install snap ring.

Special Tool
(B): 09941-74910

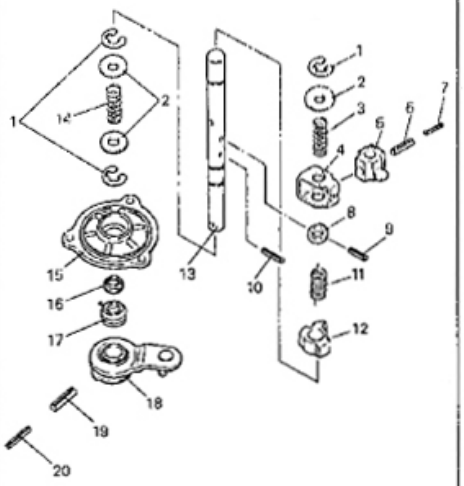
11) Using the same special tool, drive in countershaft drive gear.



12) Press-fit rear bearing inner spacer by using special tool and hammer.

Special Tool
(C): 09925-98221

13) Apply gear oil to outer surface of spacer.



1. E-ring
2. Washer
3. Low select spring
4. Interlock plate
5. Gear shift & select lever
6. Shift & select lever outer pin
7. Shift & select lever inner pin
8. 5th & REV gear shift cam guide
9. Cam guide pin
10. REV interlock shaft pin
11. Cam guide return spring
12. 5th & REV gear shift cam guide
13. Gear shift & select shaft
14. REV select spring
15. Guide case
16. Oil seal
17. Oil boot
18. Shift cable lever
19. Shift cable lever outer pin
20. Shift cable lever inner pin

GEAR SHIFTER

GEAR SHIFT & SELECT SHAFT ASSEMBLY

1) To disassembly component parts, use special tools and 2.8 – 3.0 mm (0.11 in.) pin remover in addition.

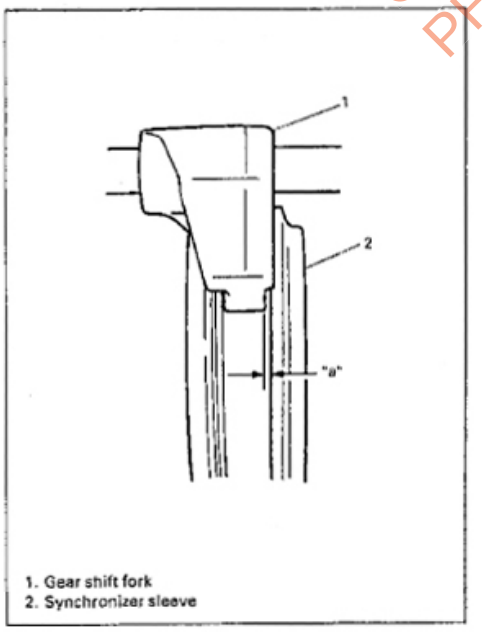
Special Tool
(A): 09922-85811 (4.5 mm)
(B): 09925-78210 (6.0 mm)

2) Clean all parts thoroughly, inspect them and replace with new ones as required.
3) Assemble component parts by reversing removal procedure.
4) If oil seal is replaced,apply grease to its lip.

"A" : Grease 99000-25010

NOTE:

- **When driving in spring pins, prevent shaft from being bent by supporting it with wood block.**
- **Assemble 5th & REV gear shift cam by winding cam guide return spring, and then drive in spring pin.**
- **Locate low speed select spring (Green) and reverse select spring (Yellow) correctly.**



1. Gear shift fork
2. Synchronizer sleeve

HIGH SPEED, LOW SPEED AND 5TH & REV GEAR SHIFT SHAFTS

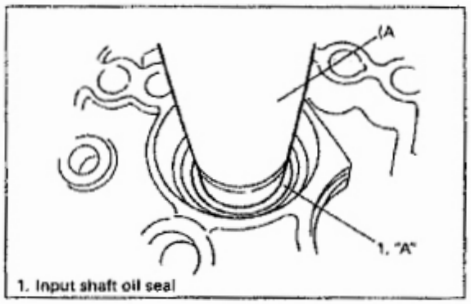
Inspection

1) Using feeler gauge, check clearance between fork and sleeve and replace those parts if it exceeds limit of 1.0 mm (0.039 in.).

NOTE:
For correct judgement of parts replacement, carefully inspect contact position of fork and sleeve.

Clearance "a": Service limit 1.0 mm (0.039 in.)

2) Insert each gear shift shaft into case and check that it moves smoothly. If it doesn't, correct by using oilstone, reamer or the like.



1. Input shaft oil seal

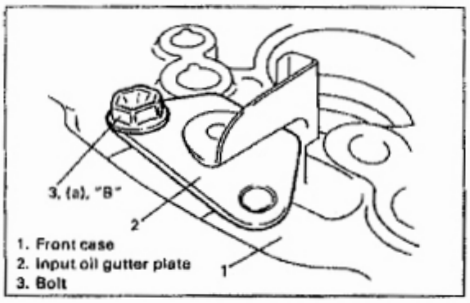
UNIT ASSEMBLY

FRONT AND REAR CASE

1) Install input shaft oil seal facing its spring side to clutch side. Use special tool and hammer for installation and apply grease to oil seal lip.

"A": GREASE , 99000-25010

Special Tool
(A): 09941-74910

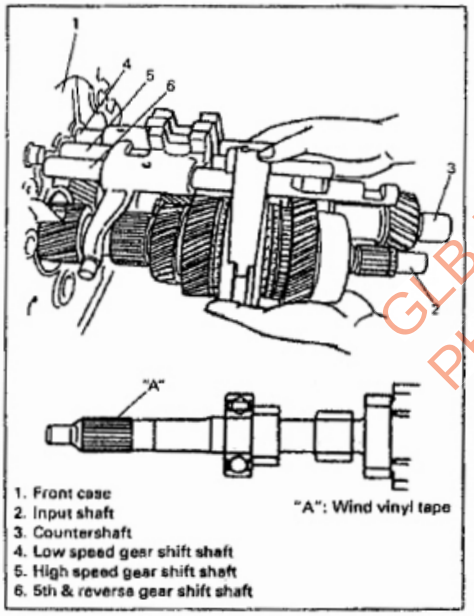


1. Front case
2. Input oil gutter plate
3. Bolt

2) If input oil gutter has been removed, install it with bolt applied with thread lock cement.

"B": Thread lock 1322, 99000-32110

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



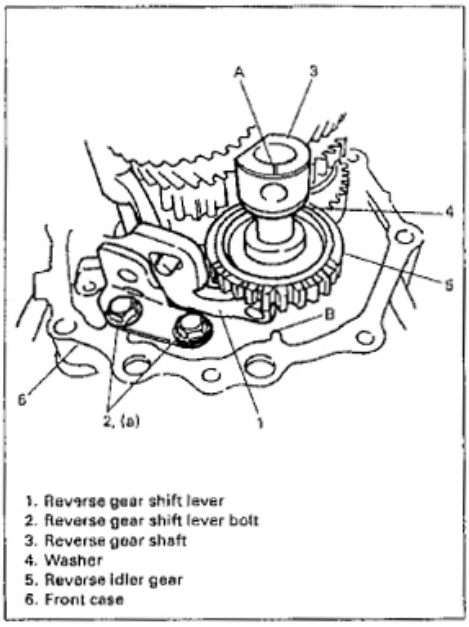
1. Front case
2. Input shaft
3. Countershaft
4. Low speed gear shift shaft
5. High speed gear shift shaft
6. 5th & reverse gear shift shaft

"A": Wind vinyl tape

3) Join input shaft, countershaft, low speed gear shift shaft, high speed gear shift shaft and 5th & reverse gear shift shaft assemblies all together, then install them into front case.

NOTE:
Input shaft front bearing on shaft can be installed into front case by tapping shaft with plastic hammer.

CAUTION:
To protect the oil seal from damage, wind vinyl tape to the spline section of the input shaft when installing it.



1. Reverse gear shift lever
2. Reverse gear shift lever bolt
3. Reverse gear shaft
4. Washer
5. Reverse idler gear
6. Front case

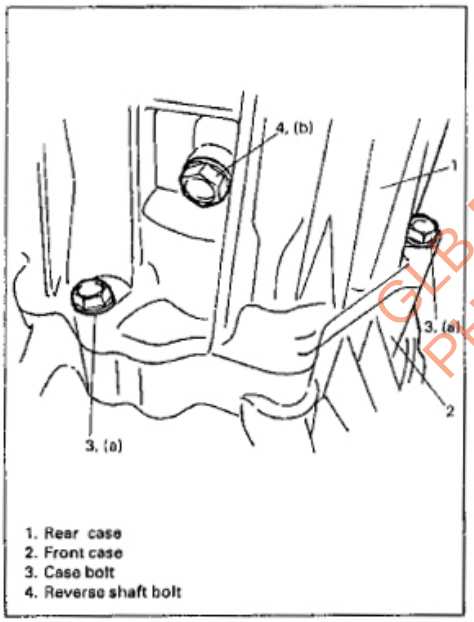
4) Place reverse gear shift lever, fasten it with 2 bolts applied with thread lock cement.

"B": Thread lock cement 1322, 99000-32110

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

5) Make reverse idler gear with reverse gear shift lever, insert reverse gear shaft applied with gear oil into case through idler gear and then align A in shaft with B in case.

NOTE:
Make sure that washer has been installed in shaft at above the gear.



1. Rear case
2. Front case
3. Case bolt
4. Reverse shaft bolt

6) Clean mating surfaces of both front and rear cases, coat mating surface of front case with sealant evenly then mate it with rear case.

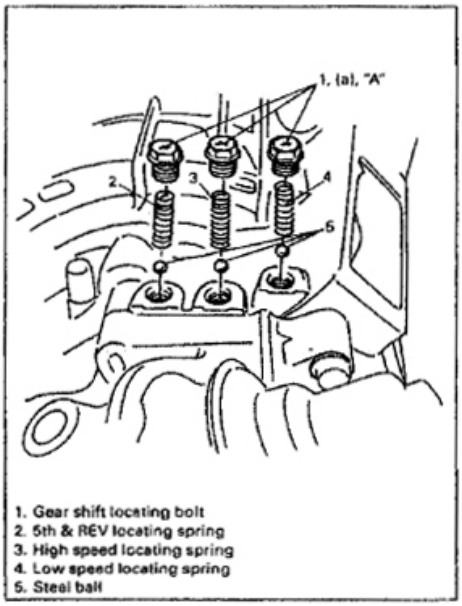
7) Tighten case bolts from outside to specified torque.

Tightening Torque
(a): 19 N·m (1.9 kg-m, 14.0 lb-ft)

8) Install reverse shaft bolt with aluminum washer and tighten it.

Tightening Torque
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

9) Install another 3 case bolts from front case side and tighten them to the same specification.
If vinyl tape has not been removed, remove it.



1. Gear shift locating bolt
2. 5th & REV locating spring
3. High speed locating spring
4. Low speed locating spring
5. Steel ball

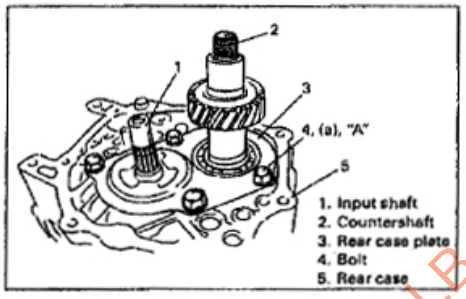
10) Check locating spring for deterioration and replace with new one as necessary.

Locating spring free length	Standard	Service Limit
High speed, 5th & REV	36.7 mm (1.445 in.)	35.6 mm (1.402 in.)
Low	46.7 mm (1.839 in.)	45.6 mm (1.795 in.)

11) Install steel ball and locating spring for respective gear shift shaft and tighten with bolt applied with thread lock cement.

"A" : Thread lock 1322, 99000-32110

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)



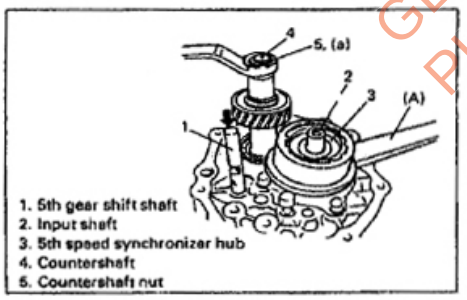
1. Input shaft
2. Countershaft
3. Rear case plate
4. Bolt
5. Rear case

MAIN SHAFT

1) Install countershaft center bearing snap ring, place rear case plate and fasten it with 5 bolts applied with thread lock cement.

"A" : Thread lock 1322, 99000-32110

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



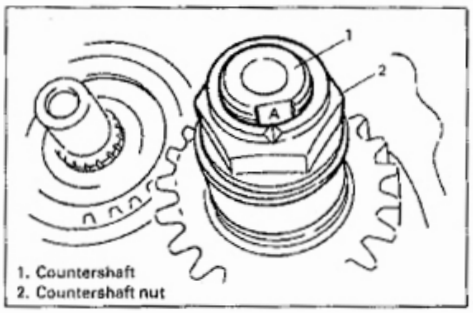
1. 5th gear shift shaft
2. Input shaft
3. 5th speed synchronizer hub
4. Countershaft
5. Countershaft nut

2) Push low speed gear shift shaft by using 5th gear shift shaft as shown in figure so that countershaft is engaged with input shaft.
3) Install 5th speed synchronizer hub together with special tool so as the shaft not to rotate.

Special Tool
(A): 09927-25411

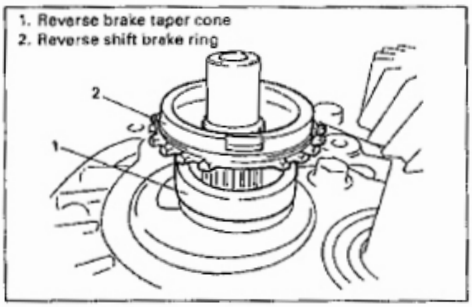
4) Install countershaft nut and tighten it to specification.

Tightening Torque
(a): 68 N·m (6.8 kg-m, 49.0 lb-ft)



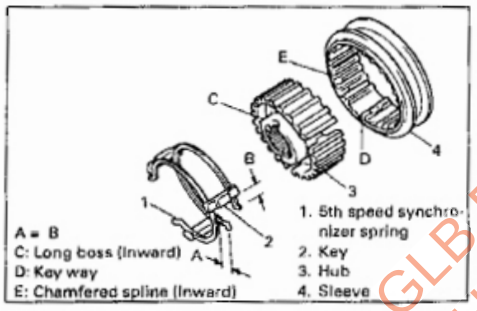
1. Countershaft
2. Countershaft nut

5) Remove special tool, then caulk nut at A with caulking tool and hammer.



1. Reverse brake taper cone
2. Reverse shift brake ring

6) Place reverse brake taper cone, apply gear oil to its taper portion and then install reverse shift brake ring.

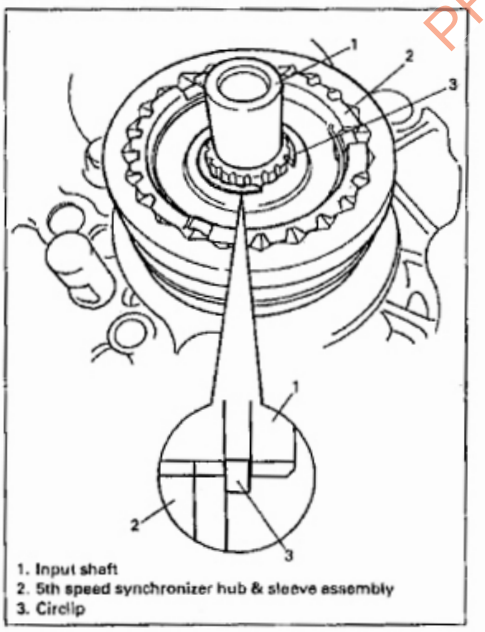


A = B
C: Long boss (Inward)
D: Key way
E: Chamfered spline (Inward)

1. 5th speed synchronizer spring
2. Key
3. Hub
4. Sleeve

7) Assemble 5th speed synchronizer sleeve and hub with keys and springs.

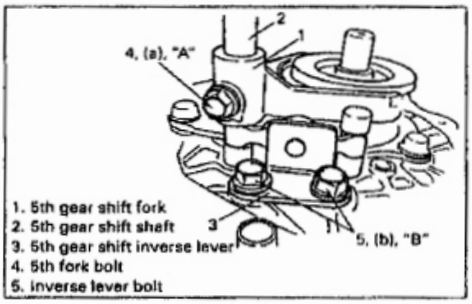
NOTE:
Long boss C in hub and chamfered spline E in sleeve should face inward (rear case side).



1. Input shaft
2. 5th speed synchronizer hub & sleeve assembly
3. Circlip

8) Install 5th gear synchronizer sleeve & hub assembly with long boss of hub facing rear case side.
9) Install circlip in correct direction as shown in figure.

CAUTION:
Confirm that circlip is installed in groove securely.



10) Fit 5th speed shift fork sleeve & hub assembly, and then install 5th gear shift shaft.
11) Tighten 5th fork bolt applied with thread lock cement.

"A" : Thread lock 1322, 99000-32110

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

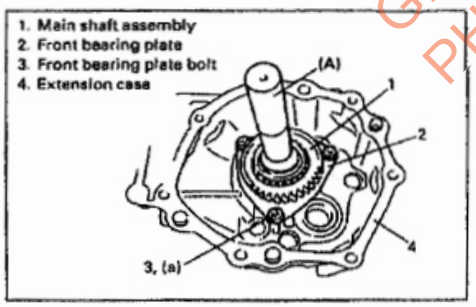
12) Install 5th gear shift inverse lever and tighten bolts applied with thread lock cement.

"B" : Thread lock 1322, 99000-32110

Tightening Torque
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

EXTENSION CASE

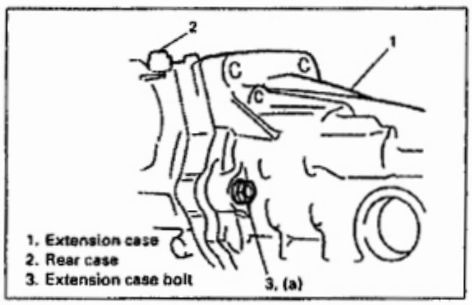
1) If oil seal has been removed, install it referring to 7A-5.



2) Install main shaft assembly into extension case by using special tool and hammer and then tighten front bearing plate bolts to specification.

Special Tool
(A) : 09925-98210

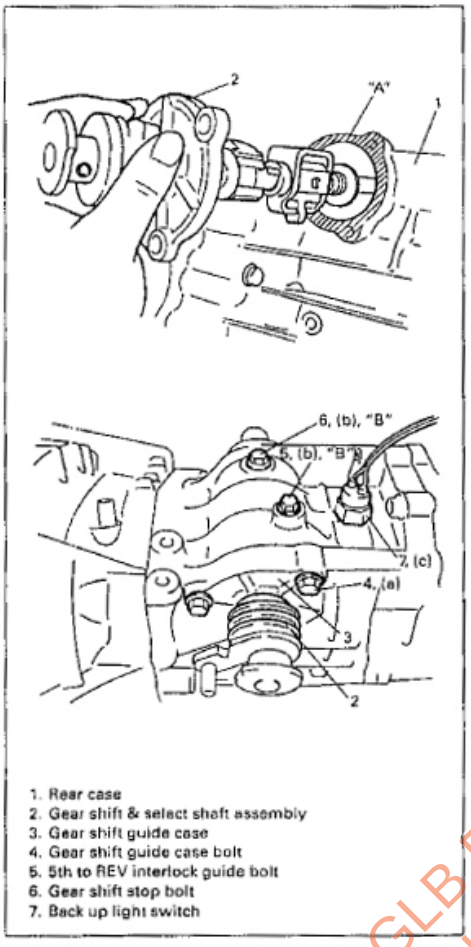
Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



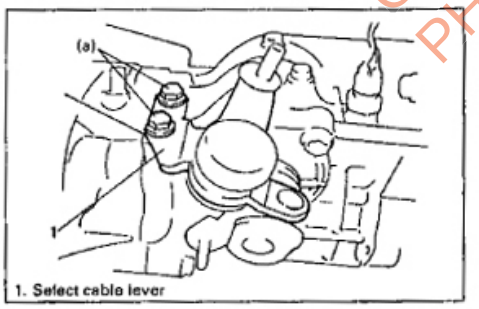
3) Clean mating surface of both extension case and rear case, coat mating surface of rear case with sealant evenly, mate it with extension case and then tighten with 7 bolts.

"A": Sealant 99000-31110

Tightening Torque:
(a): 19 N·m (1.9 kg-m, 14.0 lb-ft)



1. Rear case
2. Gear shift & select shaft assembly
3. Gear shift guide case
4. Gear shift guide case bolt
5. 5th to REV interlock guide bolt
6. Gear shift stop bolt
7. Back up light switch



1. Select cable lever

GEAR SHIFT & SELECT SHAFT ASSEMBLY

1) Clean mating surface of both rear case and gear shift guide case, coat mating surface of rear case with sealant evenly and install gear shift & select shaft assembly.

"A" : Sealant 99000-31110

NOTE:
When installing gear shift & select shaft assembly, position gear in neutral so that gear shift lever will go in smoothly.

2) Tighten 3 bolts to specification

Tightening Torque
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install 5th to REV interlock guide bolt applied with thread lock cement, gear shift stop bolt applied with thread lock cement and back up light switch.

"B" : Thread lock 1322, 99000-32110

Tightening Torque
(b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
(c) : 20 N·m (2.0 kg-m, 14.5 lb-ft)

4) Place select cable lever and fasten it with 2 bolts.

Tightening Torque
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

5) Check input shaft for rotation in each gear position.
Also confirm function of back up light switch in reverse position by using ohmmeter. There should be continuity when gear is in reverse position.

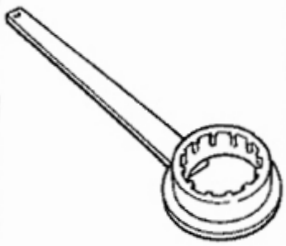
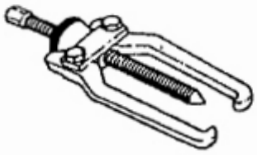
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Drain & level/filler plugs	23	2.3	17.0
Propeller shaft universal joint flange bolts	55	5.5	40.0
Gear shift control lever bolts	13	1.3	9.5
Select cable lever bolts	23	2.3	17.0
Speedometer driven gear case bolt	10	1.0	7.5
Rear mounting bolts	50	5.0	36.0
Left stiffner bolts	55	5.5	40.0
Right stiffner bolts	61	6.1	44.0
Cylinder block & T/M case nuts	61	6.1	44.0
Cylinder block & T/M case bolts	61	6.1	44.0
Control cable bracket bolts	23	2.3	17.0
Oil gutter plate bolt	10	1.0	7.5
Reverse gear shift lever bolts	23	2.3	17.0
Front-rear case bolts	19	1.9	14.0
Reverse shaft bolt	23	2.3	17.0
Gear shift locating shaft bolt	13	1.3	9.5
Rear case plate bolts	23	2.3	17.0
Counter shaft nut	68	6.8	49.0
5th fork bolt	10	1.0	7.5
5th gear shift lever bolts	23	2.3	17.0
Main shaft front bearing plate bolts	23	2.3	17.0
Extension case bolts	19	1.9	14.0
Gear shift guide case bolts	23	2.3	17.0
5th to REV interlock guide bolt	23	2.3	17.0
Gear shift stop bolt	23	2.3	17.0
Back up light switch	20	2.0	14.5

REQUIRED SERVICE MATERIALS

MATERIALS	USE
Lithium grease	• Control cable rear washers • Speedometer driven gear • Speedometer driven gear case O-ring • Speedometer driven gear case oil seal • Extension case oil seal • Propeller shaft front end • Gear shift shaft oil seal • Input shaft oil seal
Sealant	• Oil drain & level/filler plugs • Mating surface of transmission case • Mating surface of gear shift guide case
Thread lock cement	• Control lever knob • Reverse gear shift lever bolts • Oil gutter bolt • Rear case plate bolts • 5th gear shift fork bolt • 5th to REV interlock guide bolt • Gear shift stop bolt • Gear shift locating bolt

SPECIAL TOOLS

 09900-06107 Snap ring pliers (Opening type)	 09940-51710 Bearing installer	 09927-25411 Hub holder	 09913-65135 Bearing puller
 09925-18010 Bearing installer	 09951-16080 Bearing installer	 09940-54950 Bearing installer attachment	 09913-84510 Bearing installer

09925-98221
Bearing installer

09913-85230
Bearing puller attachment

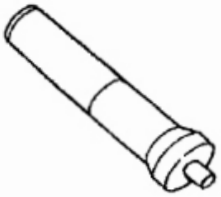
09940-53111
Bearing installer

09913-85210
Bearing installer

09922-85811
Spring pin remover 4.5 mm

09925-78210
Spring pin remover 6 mm

09941-74910
Bearing installer



09925-98210
Input shaft bearing
installer

09916-46010
Valve guide remover

SECTION 7C

CLUTCH

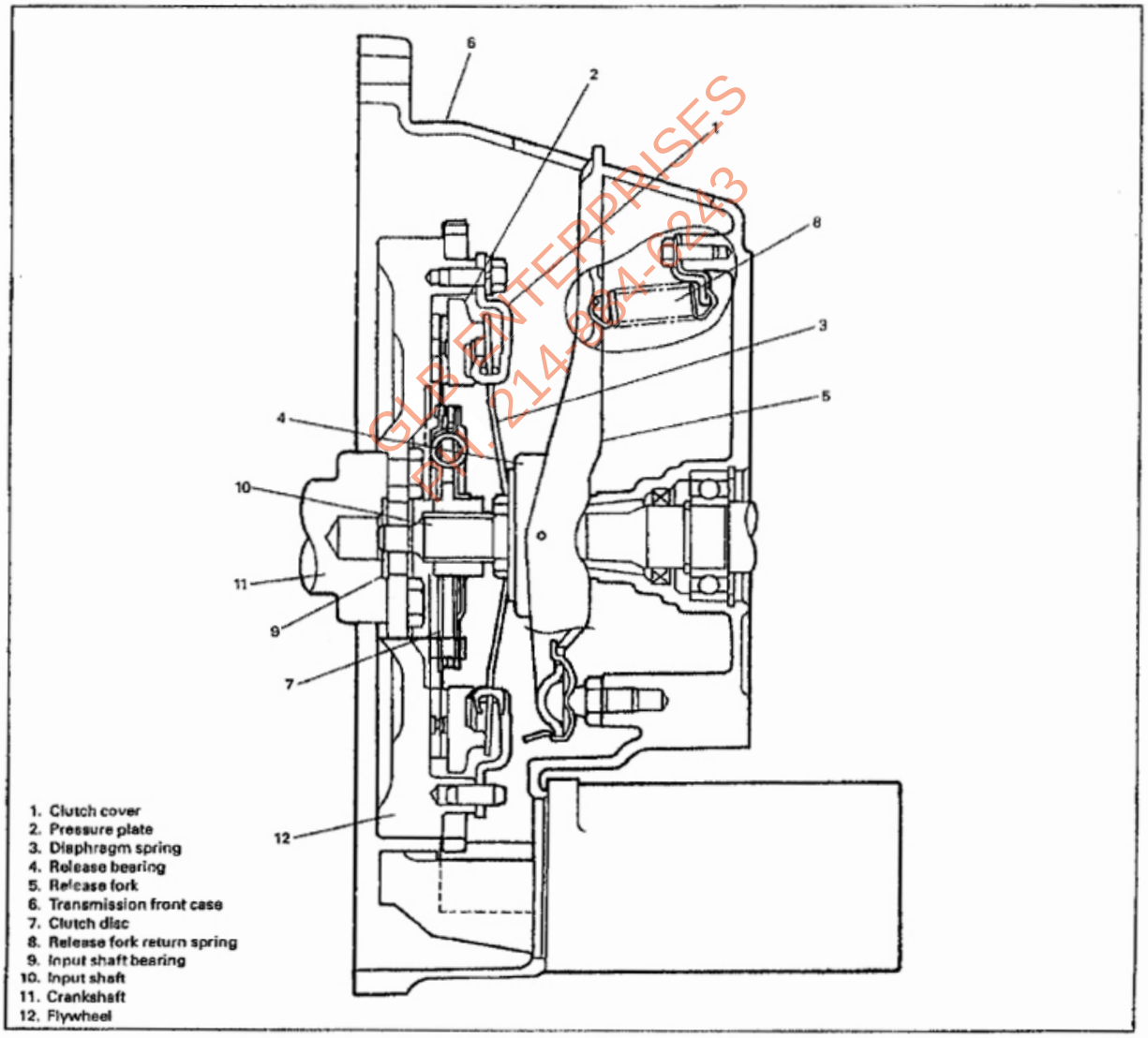
CONTENTS

GENERAL DESCRIPTION

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a tapering-finger type, which is a solid ring in the outer diameter part, with a series of tapering fingers pointing inward. The disc, carrying three torsional coil springs, is slidably mounted on the transmission input shaft with a serration fit.

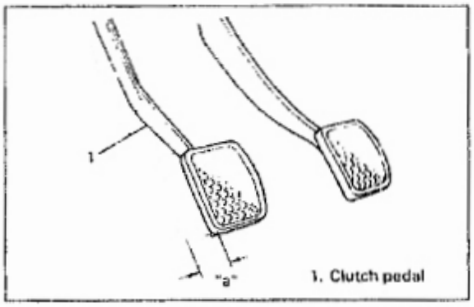
The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back : This is the engaged condition of the clutch.

Depressing the clutch pedal causes the release bearing to advance and push on the tips of the tapering fingers of the diaphragm spring. When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.



DIAGNOSIS

Condition	Possible Cause	Correction
Slipping	• Improper clutch pedal free travel.	Adjust free travel.
	• Worn or oily clutch disc facing.	Replace disc.
	• Warped disc, pressure plate or flywheel surface.	Replace disc, clutch cover or flywheel.
	• Weakened diaphragm spring.	Replace clutch cover.
	• Rusted clutch cable.	Replace cable.
Dragging clutch	• Improper clutch pedal free travel.	Adjust free travel.
	• Weakened diaphragm spring, or worn spring tip.	Replace clutch cover.
	• Rusted input shaft splines.	Lubricate.
	• Damaged or worn splines of transmission input shaft.	Replace input shaft.
	• Excessively wobbly clutch disc.	Replace disc.
	• Clutch facings broken or dirty with oil.	Replace disc.
Clutch vibration	• Glazed (glass-like) clutch facings.	Repair or replace disc.
	• Clutch facings dirty with oil.	Replace disc.
	• Release bearing slides unsmoothly on input shaft bearing retainer.	Lubricate or replace input shaft bearing retainer.
	• Wobbly clutch disc, or poor facing contact.	Replace disc.
	• Weakened torsion springs in clutch disc.	Replace disc.
	• Clutch disc rivets loose.	Replace disc.
	• Distorted pressure plate or flywheel surface.	Replace clutch cover or flywheel.
	• Weakened engine mounting or loosened mounting bolt or nut.	Retighten or replace mounting.
Noisy clutch	• Worn or broken release bearing.	Replace release bearing.
	• Input shaft front bearing worn down.	Replace input shaft bearing.
	• Excessive rattle of clutch disc hub.	Replace disc.
	• Cracked clutch disc.	Replace disc.
	• Pressure plate and diaphragm spring are rattling.	Replace clutch cover.
Grabbing clutch	• Clutch disc facings are soaked with oil.	Replace disc.
	• Clutch disc facings are excessively worn.	Replace disc.
	• Rivet heads are showing out of the facing.	Replace disc.
	• Torsion springs are weakened.	Replace disc.

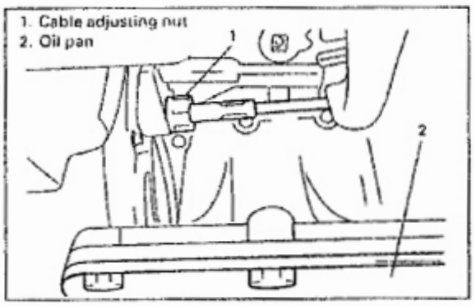


ON-VEHICLE SERVICE

CLUTCH PEDAL FREE TRAVEL

1) Depress clutch pedal, stop the moment clutch resistance is felt, and measure distance (clutch pedal free travel). Free travel should be within following specification.

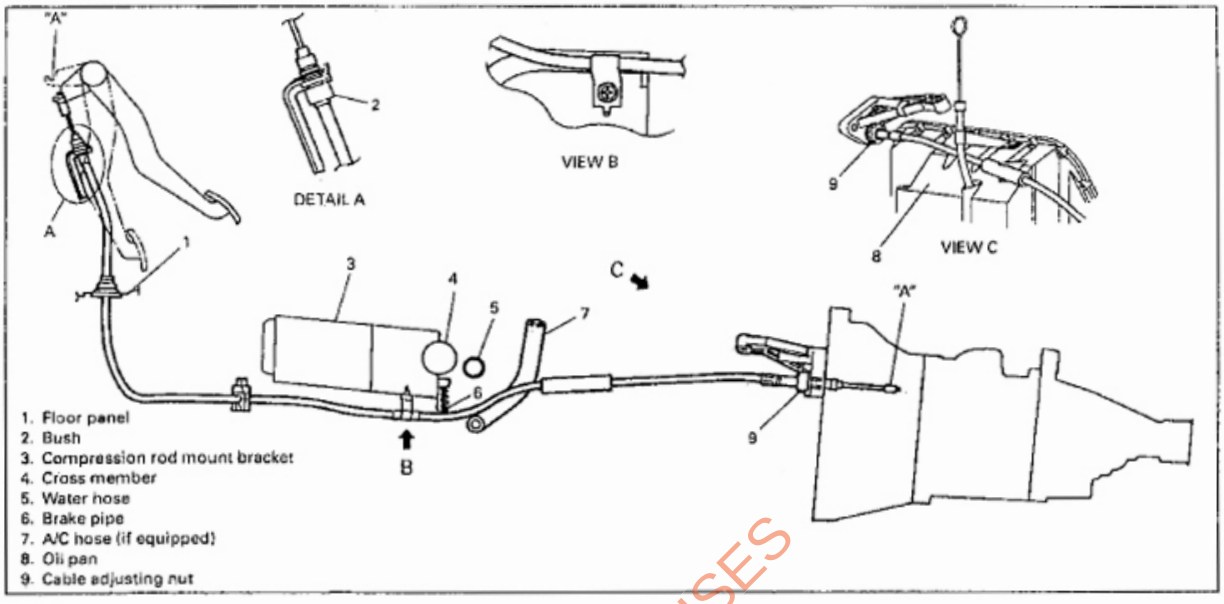
Pedal free travel "a": 10 – 15 mm (0.6 – 0.8 in.)



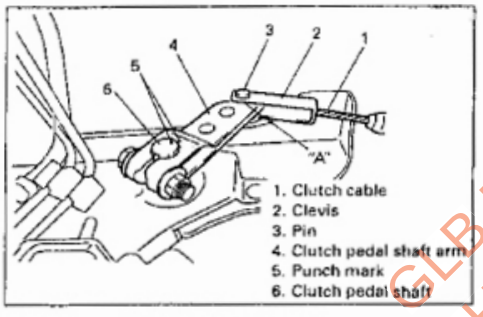
2) If free travel is out of specification, adjust it by turning cable adjusting nut.

3) After checking clutch pedal free travel, also check clutch for proper function with engine running.

CABLE ROUTING



1. Floor panel
2. Bush
3. Compression rod mount bracket
4. Cross member
5. Water hose
6. Brake pipe
7. A/C hose (if equipped)
8. Oil pan
9. Cable adjusting nut

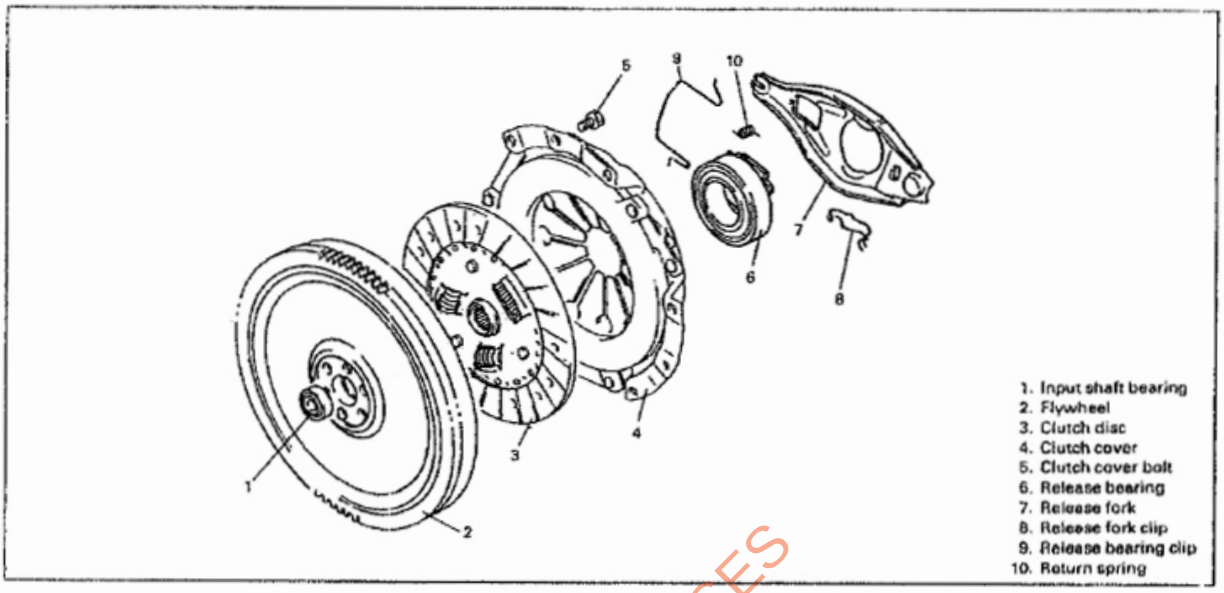


1. Clutch cable
2. Clevis
3. Pin
4. Clutch pedal shaft arm
5. Punch mark
6. Clutch pedal shaft

- When installing clutch pedal shaft arm to clutch pedal shaft, align punch marks as shown in figure.
- Apply grease to pin, clevis and arm before installing cable.

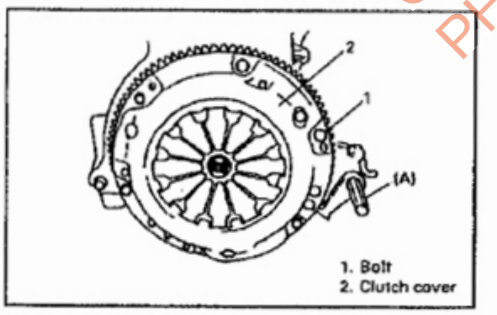
"A" : Grease 99000-25010

UNIT REPAIR



DISMOUNTING / REMOUNTING

Refer to SECTION 7A for dismounting/remounting of manual transmission.

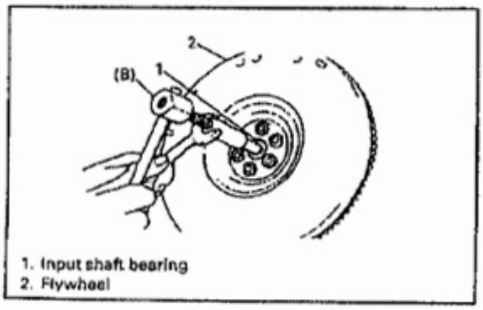


CLUTCH COVER, CLUTCH DISC AND FLYWHEEL

REMOVAL

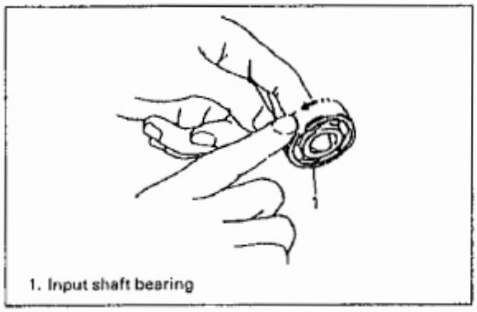
1) Hold flywheel stationary with special tool (A) and remove clutch cover bolts, clutch cover and clutch disc.

Special Tool
(A): 09924-17810



2) Pull out input shaft bearing by using special tool (B) and wrench.

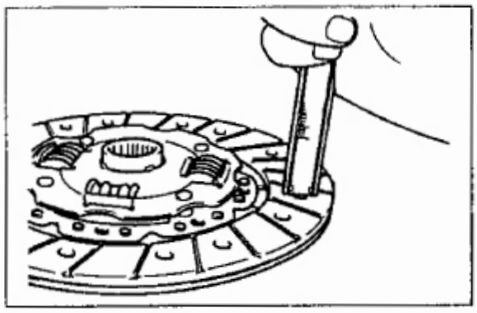
Special Tool
(B): 09917-58010


1. Input shaft bearing

INSPECTION

Input Shaft Bearing

Check bearing for smooth rotation and replace it if abnormality is found.

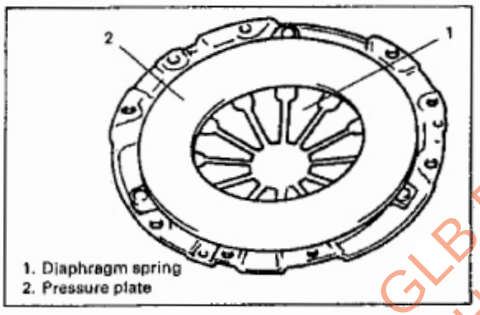


Clutch Disc

Measure depth of rivet head depression, i.e. distance between rivet head and facing surface. If depression is found to have reached service limit at any of holes, replace disc assembly.

Rivet head depth

Standard:	**1.2 mm (0.06 in.)**
Service limit:	**0.5 mm (0.02 in.)**



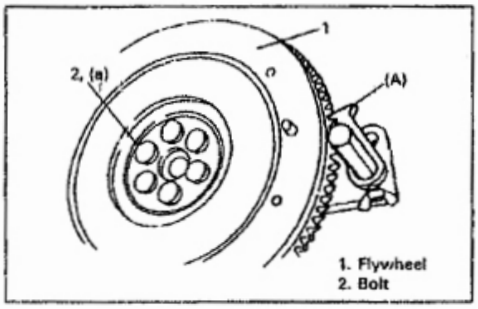
1. Diaphragm spring
2. Pressure plate

Clutch Cover

1) Check diaphragm spring for abnormal wear or damage.
2) Inspect pressure plate for wear or heat spots.
3) If abnormality is found, replace it as assembly. Do not disassemble it into diaphragm and pressure plate.

Flywheel

Check surface contacting clutch disc for abnormal wear or heat spots. Replace or repair as required.

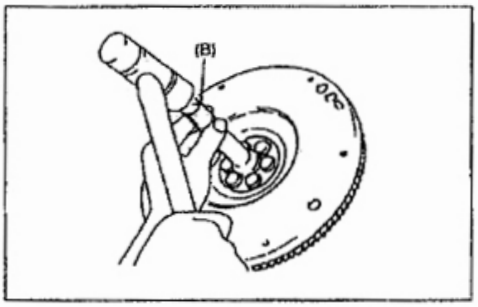


1. Flywheel
2. Bolt

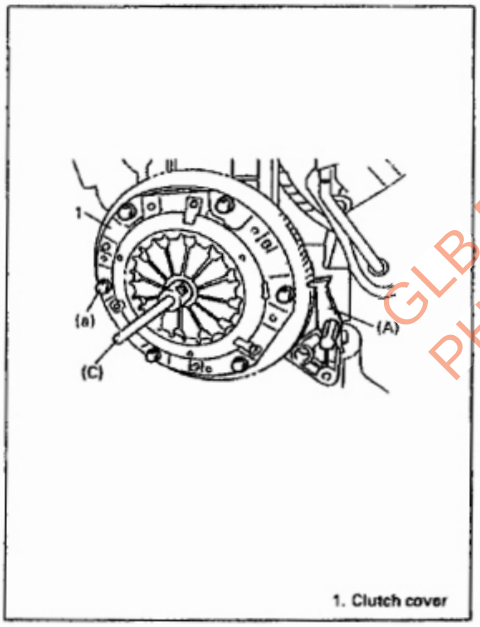
INSTALLATION

NOTE:
Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.

1) Install flywheel to crankshaft and tighten bolts to specification.
   Special Tool
   (A): 09924-17810
   Tightening Torque
   (a): 78 N·m (7.8 kg-m, 56.5 lb-ft)



2) Using special tool, install input shaft bearing to flywheel.
   Special Tool
   (B): 09925-98210

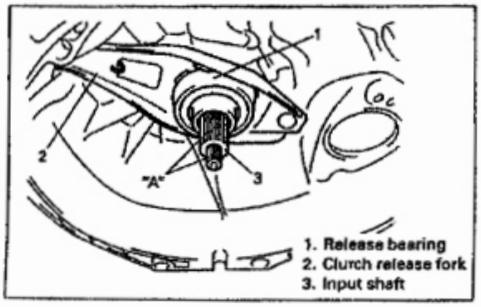


1. Clutch cover

3) Aligning clutch disc to flywheel center by using special tool install clutch cover and bolts. Then tighten bolts to specification.
   NOTE:
   - **While tightening clutch cover bolts, compress clutch disc with special tool (C) by hand so that disc centered**
   - **Tighten cover bolts little by little evenly in diagonal order.**

   Special Tools
   (A): 09924-17810
   (C): 09923-36330

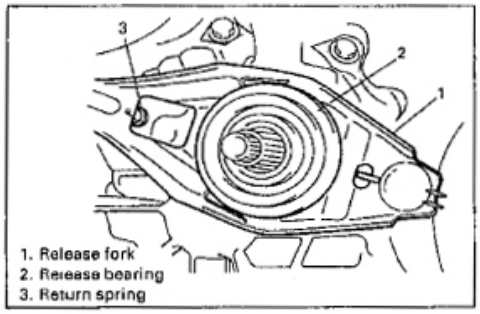
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 16.5 lb-ft)



1. Release bearing
2. Clurch release fork
3. Input shaft

4) Slightly apply grease to input shaft, then join transmission assembly with engine. Refer to SECTION 7A for remounting procedure.
   "A": Grease 99000-25210

   NOTE:
   Turn crankshaft with wrench from front while inserting transmission input shaft to clutch disc until splines mesh.

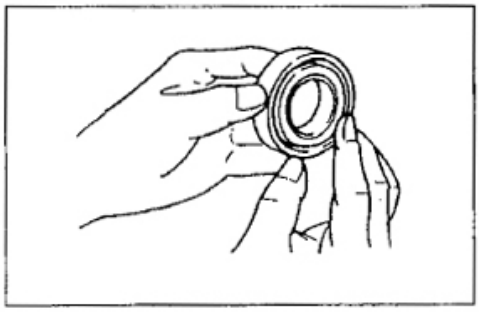


1. Release fork
2. Release bearing
3. Return spring

CLUTCH RELEASE FORK

REMOVAL

1) Remove release fork return spring and release fork clip.
2) Remove release fork together with release bearing.



INSPECTION

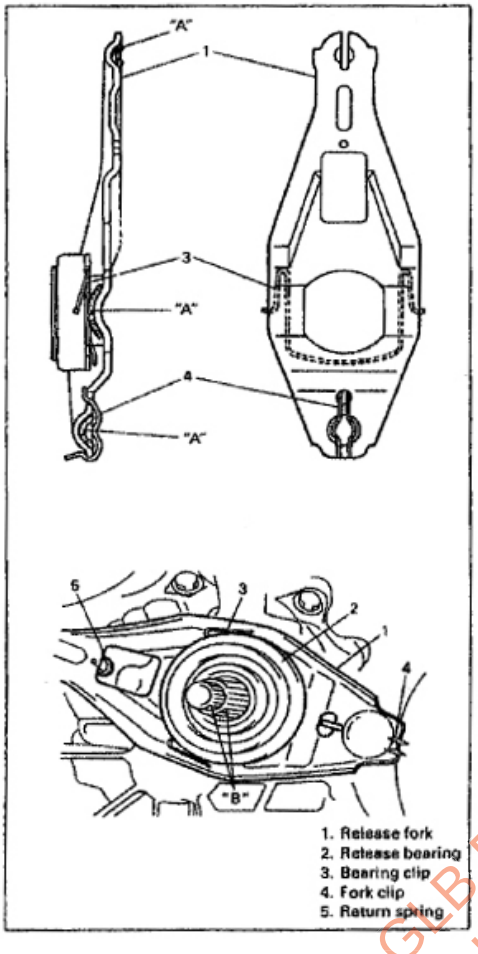
Clutch release bearing

Check clutch release bearing for smooth rotation.
If abnormality is found, replace it.

CAUTION:
Do not wash release bearing. Washing may cause grease leakage and consequential bearing damage.

Clutch release fork

Check clutch release fork and its clip for deflection or damage.
Check also release fork return spring.
If abnormality is found, replace it.



1. Release fork
2. Release bearing
3. Bearing clip
4. Fork clip
5. Return spring

INSTALLATION

Reverse removal procedure for installation noting following.

- Apply grease as shown in figure.

  "A" : Grease 99000-25010
  "B" : Grease 99000-25210

- Install release bearing, return spring and clips to release fork as shown in figure.

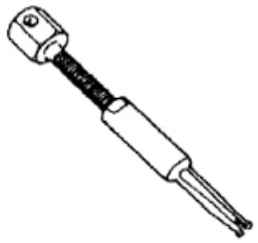
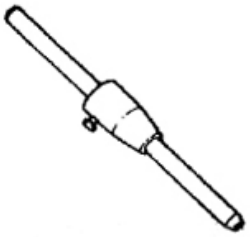
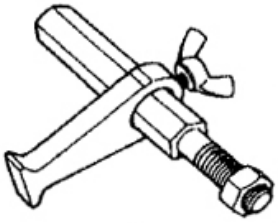
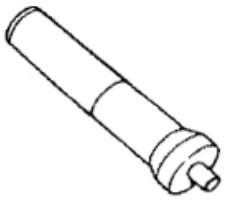
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
1. Flywheel bolts	78	7.8	56.5
2. Clutch cover bolts	23	2.3	16.5

REQUIRED SERVICE MATERIALS

MATERIAL	USE
Lithium grease	• Clutch pedal shaft arm. • Clutch release fork.
	Input shaft spline front end.

SPECIAL TOOLS

			
09917-5801 Bearing remover	09923-36330 Clutch center guide	09924-17810 Flywheel holder	09925-98210 Input shaft bearing installer

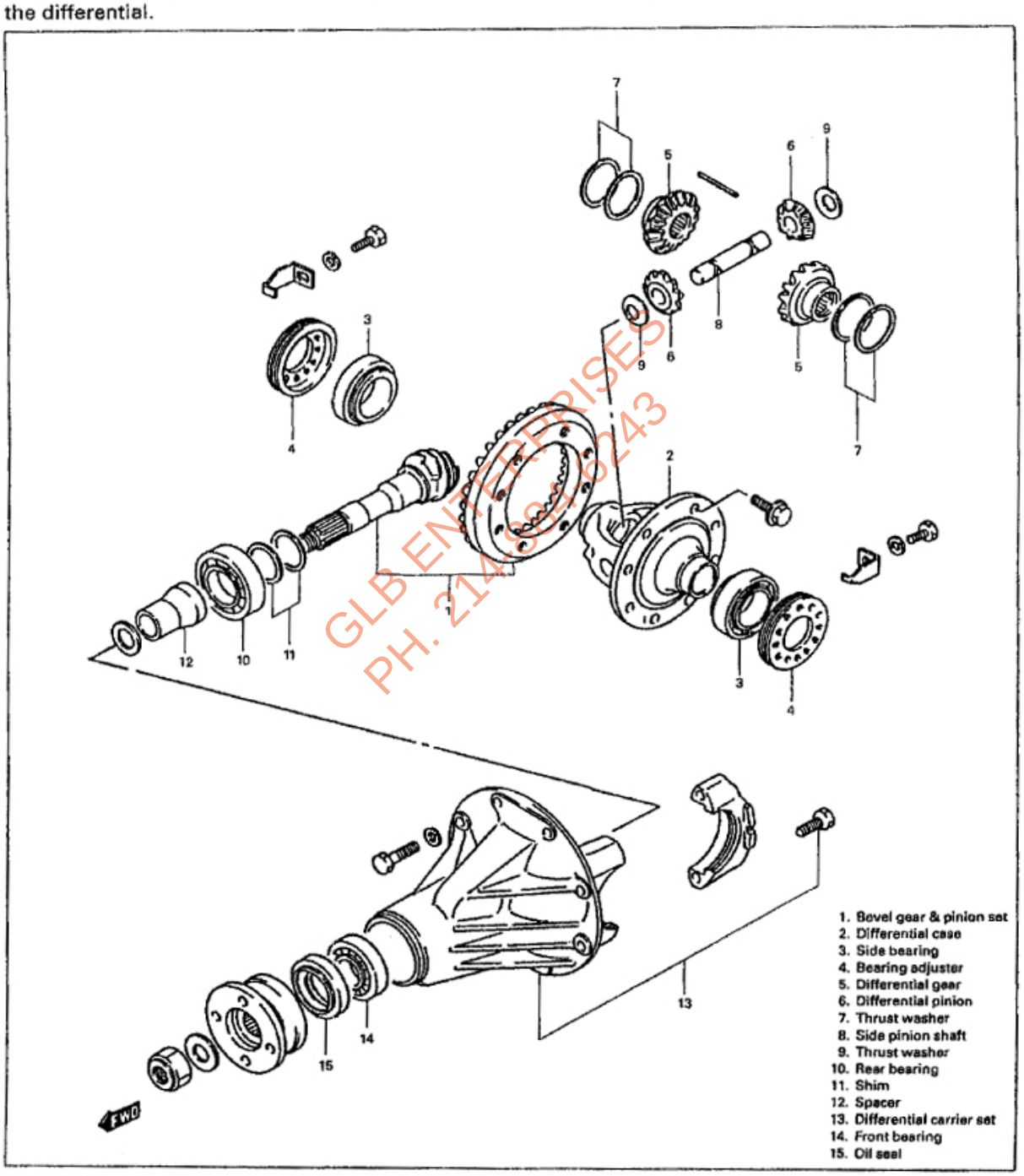
SECTION 7F

DIFFERENTIAL

CONTENTS

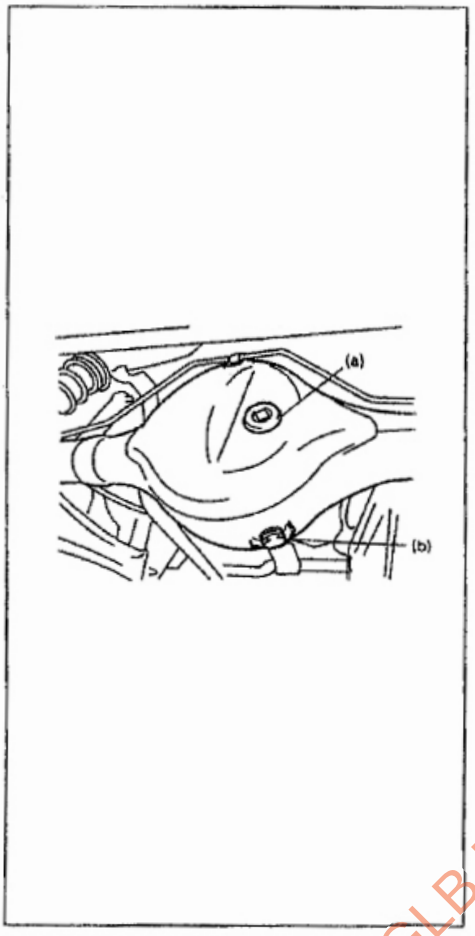
GENERAL DESCRIPTION

The components of the differential are shown in figure below. The bevel gear drive is of hypoid design; pinion and gear have hypoid gear teeth. This means that the pinion is located slightly below the center of the bevel gear to permit the car body to be lowered in design, and that some wiping or sliding action occurs in tooth meshing between pinion and gear. Here lies the reason why use of hypoid gear oil is specified for the differential.



DIAGNOSIS

Condition	Possible Cause	Correction
Gear noise	• Deteriorated or water mixed lubricant	Repair and replenish
	• Inadequate or insufficient lubricant	Repair and replenish
	• Maladjusted backlash between bevel pinion and gear	Adjust
	• Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace
	• Loose bevel gear securing bolts	Replace or retighten
	• Damaged differential gear(s) or pinion(s)	Replace
Bearing noise	• (Constant noise) Deteriorated or water mixed lubricant	Repair and replenish
	• (Constant noise) Inadequate or insufficient lubricant	Repair and replenish
	• (Noise while coasting) Damaged bearing(s) of bevel pinion	Replace
	• (Noise while turning) Damaged diff. side bearing(s) or axle bearing(s)	Replace
Oil leakage	• Clogged breather plug	Clean
	• Worn or damaged oil seal	Replace
	• Excessive oil	Adjust oil level



ON-VEHICLE SERVICE

OIL CHANGE

1) Remove oil drain plug and drain oil.
2) Reinstall drain plug and tighten it to specified tightening torque.

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

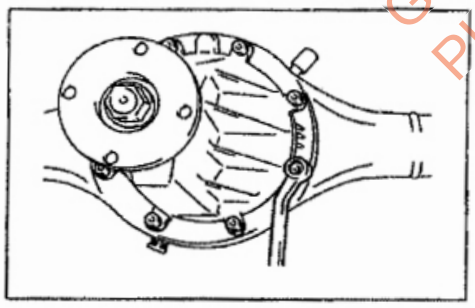
3) Remove oil level & filler plug and fill differential housing with new specified oil.
About 1.3 litre of gear oil is required to fill up differential housing.

Oil capacity	1.3 litre (2.8/2.3 US/Imp pt)
Gear oil	Hypoid gear oil, SAE 90 or Hypoid gear oil, SAE80W or 75W/80 – 85

NOTE:
For the vehicles used in areas where the ambient temperature becomes lower than –15°C (5°F) during the coldest season, it is recommended that oil be changed with SAE 80W or 75W/80 – 85 oil during the services such as a periodic maintenance.

4) Install level/filler plug and torque it to specification.

Tightening Torque
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)



REMOVAL

1) With the vehicle rested steady on safety stands, draw out right and left rear axle shafts referring to "Rear axle shaft removal" in SECTION 3E REAR SUSPENSION of this manual.
2) At differential housing, disconnect propeller shaft by removing bolts securing flange yoke to companion flange. Remove 8 bolts holding fast differential carrier case to housing, and take down carrier assembly.